Delta Programme 2020

Continuing the work on the delta: down to earth, alert, and prepared

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Including:
Delta Plan on Flood Risk Management
Delta Plan on Freshwater Supply
Delta Plan on Spatial Adaptation

Cover photo: Dry pool along the river IJssel, Gelderland

Contents

Ministerie van Infrastructuur
en Waterstaat

> Return address: Postbox 20901, NL 2500 EX The Hague

To the Chairpersons of the
Houses of the States General
Binnenhof 4
2513 AA THE HAGUE

Ministry of Infrastructure and Water Management

Rijnstraat 8
2515 XP The Hague
Postbox 20901
2500 EX The Hague

T 070-456 0000
F 070-456 1111

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Annex (es)
1

Date 17 September 2019
Subject Cabinet response to Delta Programme 2020

Dear Mr and Madam Chairperson,

It is my pleasure to present to you the Delta Programme 2020 (DP 2020). The Delta Programme is the annual proposal developed by the Delta Programme Commissioner concerning the fields of flood risk management and freshwater supply, which – as stipulated in the Water Act – is presented to you once a year. DP2020 reports on the progress of and the adjustments to the programme since 2019, and on the measures scheduled for the years ahead.
DP2020 has been developed in close collaboration between the national government, the municipalities, the district water boards, the provinces, NGOs, and the business community; it is widely supported by all the parties concerned.

In his cover letter to Delta Programme 2020, the Delta Programme Commissioner has included the following recommendation:

"With respect to the physical environment taskings that call for a collective approach, the national government intends to set down administrative agreements with the local and regional governments (in collaborative agreements under the National Environmental Vision). I recommend that you, and your counterparts at the Ministry of the Interior and Kingdom Relations and the Ministry of Agriculture, Nature and Food Quality, integrate and accommodate the goals and collective taskings of the Delta Programme in these agreements, and in addition, that you elaborate such goals and taskings, together with the local and regional governments, for each specific region in the intended Environmental Agendas. These are important steps in ensuring that the Netherlands continues to be protected against flooding, that our freshwater supply remains up to par, and that we attain the ambition of rendering the Netherlands climate-proof and water-resilient by 2050. This constitutes an essential tasking in respect of our environment and our economy."

Cabinet response

Below, I will indicate how the Cabinet intends to accommodate the Delta Programme Commissioner's recommendations (as stipulated by Article 4.9, paragraph seven of the Water Act).

The Cabinet agrees with the Delta Programme Commissioner that all the governments should observe water as a guiding principle in their environmental policies, and it endorses the aforementioned recommendations of the Delta Programme Commissioner. Consequently, the goals and collective taskings of the Delta Programme constitute an integral component of the draft National Environmental Vision. Climate change dictates a shift in mindset: climate-proof and water-resilient planning must become an inherent element in spatial (re)developments.
The essence of the Delta Decision on Spatial Adaptation is that by 2050, the Netherlands must be **climate-proof** and **water-resilient**. Government authorities are taking measures to minimise the damage caused by heat stress, waterlogging, drought and urban flooding, bearing such issues in mind in the construction of new residential areas and industrial estates, in the renovation of existing buildings, in the replacement of sewer systems, and in road maintenance work. This is a tasking that needs to be addressed in spatial policies at the national, provincial, and municipal scale levels. In collaboration with its administrative partners, the Cabinet is going to ensure that the goals of the Delta Programme (in terms of flood risk management, freshwater availability, and spatial adaptation) will be accommodated in full at the various spatial scale levels.

The four comprehensive priorities set out in the National Environmental Vision (including the goals and taskings of the Delta Programme) constitute a key basis for the establishment of the national input in the Environmental Agendas and the regional agendas for the major waters.

Yours sincerely,

THE MINISTER OF INFRASTRUCTURE AND WATER MANAGEMENT,

C. van Nieuwenhuizen Wijbenga

Deltacommissaris

> Return address Postbox 90653 2509 LR The Hague

C. van Nieuwenhuizen – Wijbenga
Minister of Infrastructure and Water Management
Postbox 20901
2500 EX The Hague

Delta Programme Commissioner
Postbox 90653
2509 LR The Hague
www.deltacommissaris.nl

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Annex(es)
1

Date 12 June 2019
Subject Presentation of Delta Programme 2020

Your Excellency,

Climate change is garnering a great deal of social and political attention. Despite the many uncertainties, we know that global warming may have a far-reaching impact, also on the Netherlands. Consequently, the Netherlands must prepare for such a future, uncertain climate change, while at the same time we must ensure – now and in the future – that we will be protected from flooding, that we have a sufficient supply of fresh water, and that our country is climate-proof and water-resilient. The drought of 2018 once more emphasised the importance of continuing to work on our freshwater supply. Your letter to the House of Representatives, presenting the first results of the Drought Policy Platform, shows that we are actively addressing these issues, inter alia, under the Delta Programme. Implementing short-term measures where needed, looking ahead to the future. Or, as we call it, Adaptive Delta Management!

Since 2010, the central government, the district water boards, the provinces and the municipalities have been collaborating within the context of the Delta Programme, with input from NGOs, knowledge institutes and the business community, to tackle the aforementioned taskings facing the Netherlands. The scope of the long-term taskings is related to the progress made at the global level in terms of the realisation of the climate mitigation goals set down in Paris. This is the uncertain backdrop against which the Delta Programme partners are continuing their efforts. Down to earth, alert, and prepared.

Presentation of Delta Programme 2020
It is my pleasure to present to you, herewith, Delta Programme 2020 (DP2020). It is the tenth consecutive annual Delta Programme, yet it is the first one that I may offer you in my capacity as Government Commissioner for the Delta Programme. True to the tradition of the established approach, my proposal has been developed in close consultation and coordination with the aforementioned Delta Programme partners. Ergo, I can assure you that the enclosed proposal for DP2020 boasts wide support.
In DP2020, I am reporting on the progress of the efforts being expended in the fields of flood risk management, freshwater availability, and spatial adaptation.

Furthermore, I have included proposals for specific measures and provisions in the three Delta Plans pertaining to these issues, in line with the task that has been imposed on me by the Water Act as amended under the Delta Act.

Adaptive delta management
DP2015 contained proposals for Delta Decisions and Preferential Strategies. Adaptive delta management entails that we closely monitor relevant developments and, if need be, proceed to adapt such Delta Decisions and Preferential Strategies. That is why once every six years, the Delta Decisions and Preferential Strategies are subjected to a systematic review. This review process commenced in mid-2018; next year, in DP2021, it may result in proposals to adapt the Delta Decisions and Preferential Strategies.

The review that is currently underway has generated the interim insight that the Delta Decisions and Preferential Strategies set down in 2015 are resilient; up until 2050, they will constitute the proper point of departure for rendering the Netherlands safe, climate-proof, and water-resilient. Consequently, according to current insights, the ongoing review will result in limited amendments, which are mainly related to increasing weather extremes, both on the wet side (cluster downpours) and on the dry side (drought and salinisation). However, after 2050, the taskings may change drastically, as by that time, the sea level may be rising at a faster pace than was assumed in DP2015. In the years ahead, the course adaptations that will be needed beyond 2050 will require a *joint fact-finding* process aimed at developing shared knowledge, garnering social commitment, and making concerted choices.

A possibility that cannot be ruled out is that the potential acceleration in sea level rise will dictate adaptation of the Delta Decisions and Preferential Strategies. However, such an acceleration in sea level rise is not expected to manifest itself before 2050. In the spring of 2018, you promised the House of Representatives that further research would be conducted into the potentially accelerated rise in sea level, and in relation to the previous Delta Programme my predecessor recommended intensification of the research being conducted into the relationship between global warming, the rising sea level, and the potential impact on the Netherlands. I note with pleasure that, meanwhile, significant steps have been taken in the development of a Sea Level Rise Knowledge Programme. This knowledge programme, which is being implemented in close collaboration with all the Delta Programme partners, will constitute a key basis for potential amendments to the Delta Decisions and Preferential Strategies in the second review of the Delta Programme, which will take place by the mid-2020s.

Recommendations for climate-proof and water-resilient spatial planning
In addition to ensuring safe flood defence systems and the availability of sufficient fresh water, future-proofing the Netherlands also calls for climate-proof spatial planning. Two years ago, the Delta Programme partners decided to draw up an annual Delta Plan on Spatial Adaptation, in order to give impetus to and intensify the spatial adaptation efforts. Under this Delta Plan, stress tests have been and are being conducted at many locations throughout the Netherlands, in order to map out the local and regional impact of potential urban flooding, severe precipitation, drought, and heat. I have noted that the stress tests are proceeding as scheduled, and that the parties concerned are actively working on the other

steps set out in the Delta Plan. Urgency has prompted the launch of increasingly more projects at the local and regional levels, whilst spatial adaptation investments have been scheduled.

I have also noted that the central government, in line with the recommendations that my predecessor has set down in relation to DP2018, has made additional resources available for spatial adaptation, and is preparing an amendment to the Water Act encompassing a temporary incentive scheme to cover the provision of Delta Fund grants for the implementation of measures to combat waterlogging. By signing the Administrative Agreement on Climate Adaptation on 20 November 2018, you reached an important milestone, together with the regional and local governments. By signing this document, the regional and local governments endorsed the agreement that co-funding is a prerequisite to qualify for such grants. Consequently, the regional and local governments will set aside additional funds for spatial adaptation.

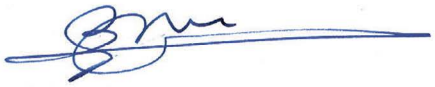
The central government, the provinces, the municipalities, and the district water boards hold the collective ambition that by 2050, the Netherlands must be as climate-proof and water-resilient as possible, whilst (re)developments must not entail any additional risk of damage and casualties as a result of urban flooding, insofar as such is reasonably feasible. This is the essence of the Delta Decision on Spatial Adaptation. In order to realise this ambition, it is important for the government authorities themselves, in their capacity of principal, to set a good example and to encourage residents and the business community to do their part. In this respect, it is imperative for residents and businesses to have access to adequate information on individual measures that may be taken to climate-proof their local environments. Only by joining forces can we do what needs to be done by 2050, in an effective and efficient manner. I set great store by the adoption of water as the guiding principle in spatial planning at every scale level. Climate-adaptive and water-resilient construction and development – being prepared for increasing waterlogging, drought, and heat, and containing the impact of potential urban flooding – should be the "new normal".

For example, it is important that flood risks are taken into account in spatial developments, in order to prevent exacerbation of the impact of urban flooding, should this occur. In my opinion, planning new developments in low-lying parts of the Netherlands that are prone to flooding would only make sense if the impact of a potential flood is factored in. Also with a view to the major spatial taskings in terms of housing and the energy transition, I ask that additional attention be focused on this issue, and I request all the governments to substantiate this in their environmental policies and their pursuit of such policies. This additional attention in environmental policy is also important in terms of ensuring the availability of sufficient groundwater and surface water, as the extremely dry summer of 2018 has shown.

The Environment Act is expected to come into force on 1 January 2021. Government authorities are preparing for the introduction of this Act. They are drawing up or have drawn up comprehensive environmental visions. The central government has set down the National Environmental Vision. The Delta Programme taskings pre-eminently involve the broad physical environment; in addition to the spatial adaptation tasking, the flood risk management and freshwater supply taskings also call for measures in the spatial domain. Many will

perceive the firm embedding of the Delta Programme taskings and goals in governmental environmental policies as a matter of course, but I want to emphasise that it is a necessity as well. This also extends to collaboration in order to be able to realise the goals set out in the Delta Programme.

Recommendations by the Delta Programme Commissioner
With respect to the physical environment taskings that call for a concerted approach, the central government is developing collaborative agreements with local and regional governments, based on the final version of the National Environmental Vision. I recommend that you, and your counterparts at the Ministry of the Interior and Kingdom Relations and the Ministry of Agriculture, Nature and Food Quality, integrate and accommodate the goals and collective taskings of the Delta Programme in these agreements, and in addition, that you elaborate such goals and taskings, together with the local and regional governments, for each specific region in the intended Environmental Agendas. These are important steps in ensuring that the Netherlands continues to be protected against flooding, that our freshwater supply remains up to par, and that we attain the ambition of rendering the Netherlands climate-proof and water-resilient by 2050. This constitutes an essential tasking in respect of our environment and our economy."



P.C.G. Glas
Government Commissioner for the Delta Programme

CHAPTER 1

Administrative introduction

(Excessively) low water level in the river Waal, Nijmegen, July 2018

In 2018, the Netherlands was faced with extreme weather conditions: prolonged drought, heat, and torrential downpours. The summer of 2019 beat the national heat record dating back to 1944. Concurrently, research has shown that in the future, the sea level may rise faster than at the pace underpinning the Delta scenarios. And the World Economic Forum (WEF) has concluded that climate change is posing the greatest threat to the world economy. This means that it is vitally important for the Netherlands to continue to prepare properly for the impact of climate change, by securing efficient flood protection, by ensuring a sufficient supply of fresh water, and by climate-proof and water-resilient spatial planning.

This tenth Delta Programme shows that the Delta Decisions and Preferential Strategies outlined in Delta Programme 2015 (DP2015) are still setting the proper course. However, the initial assessments of the six-year review – which will be completed in 2021 – have shown that minor adjustments are required. Furthermore, in order to stay on the right track, it is crucial to continue to work on the delta and to give impetus to the implementation of the measures set out in the Delta Plans on Flood Risk Management, Freshwater Supply, and Spatial Adaptation. New insights into the potentially accelerating rise in sea level have added to the uncertainties regarding measures to be taken beyond 2050. This calls for research into short-term actions needed to keep longer-term options open.

Staying alert and adjusting course where needed

With the Delta Programme, we are preparing for the future. We are gaining increasingly more knowledge of climate change, and the effects of measures are becoming increasingly manifest. At the same time, reality is constantly changing and generating new insights. That is why the Delta Decisions and Preferential Strategies are reviewed every six years. This enables a timely change of course if such is dictated. Delta Programme 2021 will comprise proposals for the review of the Delta Decisions and the regional Preferential Strategies as outlined in DP2015. The Delta Programme partners are developing such proposals step by step. Delta Programme 2020 provides the initial impetus.

The first results of the six-year review demonstrate that the Delta Decisions, as outlined in DP2015, are still robust. In May 2019, the Freshwater Administrative Platform agreed on the formulation of freshwater supply goals for 2050, analogous to those set down with respect to flood risk management and spatial adaptation. Optimum use will be made of the national goals as set down in DP2015. In the first six-year review in DP2021, the goals for 2050 will be incorporated into the Delta Decision on Freshwater Supply. Up to 2050, the Delta Decisions thus constitute the proper points of departure for rendering the Netherlands safe, climate-proof, and water-resilient. The Preferential Strategies set out in DP2015 feature an adaptive approach, which enables their adjustment if changing conditions so dictate. Adjustment will be called for in several respects, as a result of developments that had not been foreseen in DP2015, such as recurrent supercells, prolonged drought, and increasing salinisation and shipping issues during extremely low water levels.

On the right track

This tenth Delta Programme shows that the planned measures are on schedule. Based on current insights, dyke improvements need to cover a weekly average of one kilometre up to 2050. The Flood Protection Programme has adapted its course in order to intensify its efforts. Meanwhile, the ongoing dyke improvement projects have continued as scheduled. For example, in 2019, preparations for the improvement of the Markermeer dykes have commenced, the plan elaboration for the Wolferen-Sprok project will be initiated, and the Ringdijk Watergraafsmeer innovative dyke improvement project was completed. Across the board, the dyke improvements scheduled in the period up to and including 2024 are keeping pace with the progress required to have the primary flood defences meet the new standards by 2050. The schedule for the years 2020 and 2021 shows some adjustment vis-à-vis last year with respect to the realisation of "kilometres of safe dykes". Several exploratory studies are underway regarding the combination of dyke improvement and river widening along the Meuse. Progress has also been made with respect to disaster control. Nearly all the 25 security regions have completed their impact analyses and are working on strategies for action perspectives in times of (imminent) floods.

The drought of 2018 has demonstrated the effectiveness of the measures implemented under the Delta Plan on Freshwater Supply. For example, the Small-scale Water Supply was found to function well, even better than expected. The IJsselmeer water level ordinance – which came into force in June 2018 – has expanded the water buffering capacity. The implementation of the other measures involved in Phase 1 of the Delta Plan on Freshwater Supply is progressing largely according to schedule. All the freshwater supply regions and the central government are working on the climate-adaptive measures agreed upon. The drinking water sector is also investing in the resilience of our drinking water supply. Last year's drought has given impetus to the collaboration with parties working on a climate-adaptive substantiation of the farming and nature taskings; a Climate Adaptation Action Programme is being developed to address these two taskings. The Freshwater Administrative Platform, the Physical Environment Consultative Body, and the freshwater supply regions have evaluated the experience gained with respect to the period of drought. Based on these insights and recommendations of the Freshwater Administrative Platform, the Delta Programme Commissioner will draw up a proposal, in 2021, for Phase 2 of the Delta Plan on Freshwater Supply (2022 up to and including 2027), looking ahead to the long-term taskings.

January 2019 saw the introduction of the new standards for the stress tests relating to waterlogging, heat, drought, and the impact of urban flooding. Under the Delta Plan on Spatial Adaptation, virtually all the municipalities have conducted stress tests to map out their vulnerability to extreme weather. In several regions, the parties have already embarked on the subsequent ambition: conducting a risk dialogue with stakeholders regarding the strategy to tackle bottlenecks. Several measures are being implemented to reduce the Netherlands' vulnerability to weather extremes. The strategy regarding national vital and vulnerable functions has been expanded over the past year: the vulnerabilities of these types of functions are also examined at the regional and local levels.
To substantiate the Administrative Agreement on Climate Adaptation, the central government has earmarked an additional sum of 20 million euros to boost the short-term implementation of the Delta Plan on Spatial Adaptation (2019 and 2020). This boost is intended for additional process support, pilot studies, and developing and sharing knowledge; it is a supplement to the ongoing incentive programme. In addition, the central government is preparing an amendment to the Water Act, encompassing a temporary incentive scheme to cover Delta Fund grants to local and regional governments implementing measures to combat waterlogging. Co-funding is a precondition to qualify for such grants.

Remaining prepared

Joint fact finding

After 2050, the taskings may change fundamentally, as by then, the sea level may have risen faster than was assumed in DP2015. The change of course that could be required after 2050 calls for a joint fact-finding process in the years ahead, in order to develop shared knowledge, garner social commitment, and arrive at collective choices. The first six-year review will also generate knowledge requirements and recommendations for further research in preparation for the second six-year review. In the second six-year review (in DP2027) – or as much earlier as necessary – the outcomes of such research will be translated into adaptations of the Delta Decisions and the Preferential Strategies. A case in point is the Sea Level Rise Knowledge Programme (see below). With respect to the freshwater supply, a study will be initiated into the possibilities of a controllable buffer network. The Integrated Study into Flood Risk Management and Water Level Management (ISWP) conducted in the IJsselmeer Region has generated recommendations for the long-term management of the main water system (beyond 2050). Some recommendations may require additional research with a view to the next review.

Drought Policy Platform

The measures that have been implemented in recent years have boosted the Netherlands' ability to cope with prolonged drought. However, the unexpectedly long duration of the 2018 drought has resulted in salinisation in Lake IJsselmeer and sharply falling groundwater levels, in particular at the Elevated Sandy Soils and in the Southwest Delta. An initial, tentative assessment of the damage caused by the drought and the low water levels comes out at between 0.5 and 2 billion euros. The damage has mainly affected the agriculture and shipping sectors.

At the end of 2018, the Minister of Infrastructure and Water Management set up a temporary Drought Policy Platform. This affords governments and water consumers the opportunity to discuss the impact of drought and any potential (policy) recommendations. Thus, the Netherlands is preparing even better for the drought seasons of 2019 and beyond. The Minister forwarded the initial results and recommendations of the Drought Policy Platform to the House of Representatives on 4 April 2019. The Freshwater Administrative Platform, the IJsselmeer Region Administrative Platform, and the Spatial Adaptation Steering Group are addressing the recommendations. In close consultation with the Freshwater Administrative Platform partners, the Minister of Infrastructure and Water Management has set aside a sum of 7 million euros from the Delta Fund (within the resources allocated to the Delta Plan on Freshwater Supply), to be used for, inter alia, urgent projects at the Elevated Sandy Soils.

Sea Level Rise Knowledge Programme

In the spring of 2018, the Minister of Infrastructure and Water Management announced further research into a potentially accelerating rise in sea level beyond 2050. In DP2019, the Delta Programme Commissioner recommended intensification of research into the relationship between global warming and the rising sea level, and into their impact on the Netherlands. The Minister of Infrastructure and Water Management subsequently initiated the multi-year Sea Level Rise Knowledge Programme. The programme will be substantiated within the context of the Delta Programme, in collaboration with all the partners. In the years ahead, this will generate more information on how an accelerated rise in sea level will impact the Dutch delta, on options sensibly to anticipate such impact, and on ways to cope with uncertainties.

Climate-proof construction

In DP2019, the Delta Programme Commissioner recommended a climate-adaptive approach to the extensive housing tasking – in terms of both selection of locations and construction methods. The Delta Programme Steering Group has set up a working group which, at the end of 2018, produced an advisory report on reducing the impact of urban flooding. According to the working group, reducing the impact of urban flooding is essential to render spatial planning in the Netherlands water-resilient and climate-proof, not only in new developments but also in restructuring projects, management and maintenance efforts, (business) investments, and contingency plans. The Spatial Adaptation Steering Group will be actively focusing on the consideration of flood impact containment as a fully-fledged element of stress tests and other components of the Delta Plan on Spatial Adaptation (risk dialogues, ambitions, measures), and on the embedding of impact containment into government policies and regulations.

In collaboration with regional and local authorities, the central government has explored whether (construction) regulations act prohibitively on climate-proof planning. The study has shown that current national-level laws and regulations do not pose a hindrance. The current instruments afford municipal authorities particularly ample scope for "arranging" regulations regarding climate-adaptive construction and planning. The fact that they fail to take (sufficient) advantage of such opportunities can be attributed to several causes, in particular, a lack of awareness of the scope of local and regional regulations with respect to climate-adaptive construction, the lack of a sense of urgency, and a lack of the required capacity. This is why guidelines for regional and local governments will be drawn up in 2019.

The Delta Programme Commissioner has also recommended that a national soil subsidence programme be set up, to be directed by one of the Ministries. This is an important issue as regards the Delta Programme, because soil subsidence is adding to the Delta Programme taskings. Rather than a national soil subsidence programme, the Cabinet is working on a nationwide strategy to combat soil subsidence. This involves a cross-sectoral tasking that touches on the responsibilities and tasks of a range of Ministries - Agriculture, Nature and Food Quality; Economic Affairs and Climate Policy; the Interior and Kingdom Relations; Infrastructure and Water Management; and Education, Culture and Science - but also extends to local and regional governments as well as private parties. Regular consultations between the Cabinet members serve to sustain and reinforce the cohesive approach. The Green Heart Subsidence Regional Deal is giving impetus to a collective knowledge and information infrastructure. The central government has set aside 10 million euros to this end and the regional authorities are making an effort to match this sum.

Integrated River Management

The authorities in the area around the major rivers are collectively substantiating the integrated approach ambition under the Integrated River Management (IRM) programme, in parallel to the ongoing explorations in the region. All the parties agree that it is important to regard the river as a single system and to adopt an integrated approach to the taskings. IRM focuses on national and regional taskings, such as flood risk management, navigability, water quality and nature, water availability, spatial and economic development, and spatial adaptation. In recent months, the parties have mapped out the river system taskings. They are now considering which urgent taskings call for immediate attention and which require more research and strategic policy decisions, such as regarding the extent of river widening and river bed level. The Delta Programme partners are discussing the approach to and control of Integrated River Management.

Setting to work together

Working on the three Delta Programme taskings – proper flood protection, a sufficient supply of fresh water, and climate-proof and water-resilient spatial planning - is essential to keep the Netherlands liveable and habitable. These taskings cannot be tackled by any party alone.

The need for more coordination and collaboration regarding flood risk management policy issues has prompted the government to set up the Flood Risk Management Policy Platform. In this platform, the central government, the Association of Provincial Authorities, the Association of Dutch Regional Water Authorities, and the Association of Netherlands Municipalities discuss short-term and long-term national flood risk management policies, in interaction with regional flood risk management policies and the implementation of tangible measures. Following the adoption of the Delta Decision on Flood Risk Management in 2014, the Flood Risk Management Portfolio Holders Consultative Body was disbanded. The current situation appears to raise more policy-related questions than originally foreseen. The Policy Platform addresses such questions.

Collaboration is becoming increasingly important: interconnecting the three Delta Programme taskings, incorporating the Delta Programme goals into environmental policies, and linking the goals to transitions and social taskings in an area. The key challenge is to link “water” to “spatial planning”. The Netherlands is a small country and every tasking involves a major claim on the space available. A case in point is the comprehensive housing tasking. That is why it is vitally important to have the Delta Programme goals – with respect to flood risk management, freshwater supply, and spatial adaptation – incorporated into the environmental visions of the central government, provinces, and municipalities, and to factor in these goals in the preparation of actual projects in the physical domain.

The future is uncertain, but the Delta Programme partners are preparing in the best possible way. The central government, provinces, municipalities, and district water boards are working to achieve this goal day after day, as a single government and with the involvement of residents, businesses, and NGOs. At the national level, in the regions, and in projects. Step by step and in an adaptive manner. The Delta Programme Commissioner suggests measures, keeps a finger on the pulse, reports on the progress made every year, and fosters collaboration. Down to earth, alert, and prepared.

CHAPTER 2

Developments in the Delta

Wolvega-Zuid nature reserve, featuring room for water storage and rainwater collection, June 2019

This chapter outlines the progress made in the implementation of the Delta Programme, and addresses new developments in its governance, expertise, the market, innovation, and international collaboration.

2.1 Delta Programme progress outlined

Finger on the pulse

The Delta Programme looks far ahead: its measures are aimed at removing bottlenecks that are already arising on account of the changing climate, and at attaining the flood protection, freshwater supply, and spatial adaptation goals set for 2050 and beyond. The road leading there is paved with a range of developments that affect the taskings and the solutions. In addition, new insights continue to be developed, for example, into a potentially accelerated rise in sea level, and into dyke failure mechanisms. Furthermore, societal demands may shift.

In the Delta Programme, we have opted for an adaptive approach: new developments and insights may dictate revision of Preferential Strategies and (Delta) decisions set down earlier. Such revision may be effected annually, if developments so require. In 2017, the Delta Programme Steering Group decided to conduct a supplementary systematic review every six years. This procedure is explained in Background Document F (in Dutch) under DP2017.

The annual assessment is underpinned by the outcomes of the "Monitoring, Analysing, Acting" (MAA) system. This system enables the organisations involved in the Delta Programme to keep a finger on the pulse. The MAA system structures administratively relevant information on the basis of the four key questions:

- Are we on schedule: are we implementing the measures and provisions within the stipulated timeframe and under the available budget?
- Are we on track, or do external developments or shifts in societal preferences dictate adjustment of goals or measures?
- Are we addressing the taskings in an integrated manner?
- Have we garnered broad-based commitment (participation)?

The systematic six-year review entails a careful assessment of any developments that require revision of the policies that are based on the proposals for Delta Decisions and Preferential Strategies[1]. If need be, the Delta Programme Commissioner will draw up proposals for such revision. The end result is a new "picture" of the taskings, ambitions, procedure, and intended results of the Delta Programme.

First six-year review

The first six-year review commenced in mid-2018 and will be completed by the spring of 2020. DP2021 will report on the outcomes.

Three types of arguments may constitute reason to fine-tune, supplement, or revise Delta Decisions and regional Preferential Strategies:

1. modifications in calculation models (such as new parameters, data, or calculation methods);
2. assumptions that were directive in DP2015 and now require revision;
3. new knowledge and innovations, socio-economic or climatic developments, and changing societal preferences.

Deltares research institute has checked whether the first two types of arguments hold up (see www.deltacommissaris.nl). Their analysis showed that they do not constitute any reason to revise the Delta Decisions and Preferential Strategies. With respect to the third type of arguments, the Signal Group[2] has surveyed whether such developments are of overall relevance to the Delta Programme. The Signal Group has recommended that – supplementary to the developments identified by the themes and regions – the six-year review take account of the following observed or potential future developments: accelerated rise in sea level; increased risk of extremely high and extremely low river discharges; changes in land use, including the housing tasking; potential increase in spring precipitation shortages; increase in surface area to be irrigated; increasing precipitation intensity; and increasing heat stress[3]. In addition, the programme offices of the themes and regions have surveyed region-specific and theme-

[1] In this Delta Programme, such policies will henceforth be referred to as "Delta Decisions and Preferential Strategies".

[2] The Signal Group is made up of relevant experts from Rijkswaterstaat, the Netherlands Environmental Assessment Agency (PBL), Royal Netherlands Meteorological Institute KNMI, Deltares research institute, Wageningen University & Research Centre (WUR), and Statistics Netherlands (CBS). The Signal Group is chaired by the Staff of the Delta Programme Commissioner. For more information and the tasks vested with the Signal Group, see, www.deltacommissaris.nl (in Dutch).

[3] See the Signal Group recommendations to the Delta Programme Commissioner in Background Document A.

specific developments[4], and submitted the results to the Freshwater Supply and Spatial Adaptation Steering Groups, the Flood Risk Management administrative partners, and the administrative consultative bodies in the regions. The Signal Group assessed the outcomes of this process and, in the autumn of 2018, discussed them with the themes and regions programme offices. The end result constitutes the scope for the review; at the end of 2018, following discussion in the theme and regional steering groups, it was endorsed by the Delta Programme Steering Group.

The analyses lead to the following outline conclusions:

- The 2014 Delta Scenarios have been fine-tuned in recent years, using new information from the Prosperity and Quality of the Environment scenarios and the "Paris agreement". The conclusion is that in this first six-year review, minor revisions of the Delta Decisions and regional Preferential Strategies will suffice to accommodate new insights into climate change.
- The perspectives of the future are still uncertain. For that reason, continued investments in research are imperative. A knowledge programme will be initiated in order to gain a better picture of the rate at which the sea level rise will develop in the longer run (beyond 2050). The knowledge programme will also map out how a potential acceleration in sea level rise may impact our flood protection and freshwater supply.
- Several climate-related developments, such as the occurrence of supercells, drought, and salinisation, are already manifesting, which was not foreseen in 2014. Such developments may constitute reason to revise and fine-tune regional Preferential Strategies and elements of Delta Decisions.
- The impact of low water levels (such as low river discharges disrupting shipping traffic) also constitutes reason for potential revisions, in particular of the regional Preferential Strategies for the rivers Rhine and Meuse. Such revisions will be addressed in the Integrated River Management (IRM) programme.
- New insights will also be used to fine-tune or concretise Delta Decisions and Preferential Strategies.

Not all the developments observed already dictate potential revisions. Some cases first require, e.g., further research in order to determine whether they actually involve a trend that calls for a revision of the Delta Decision or regional strategy. These types of developments will be re-considered during the second six-year review.

The potential revisions of the Delta Decisions and regional Preferential Strategies are set out in Chapters 3 - 5 (pertaining to the Delta Decisions on Flood Risk Management, Freshwater Supply, and Spatial Adaptation), and in Chapter 7 (pertaining to the regional Preferential Strategies). These revisions will be elaborated further in the period ahead. DP2021 will outline proposals for revised Delta Decisions and regional Preferential Strategies.

[4] The themes and regions have also conducted a qualitative sensitivity analysis to explore whether additional measures would be required with a view to a potential 2 m rise in sea level by 2100.

Integrated approach and participation

The ambition is to address the Delta Programme taskings in an integrated manner, wherever possible, and to encourage government authorities, businesses, and residents to participate in the preparation of plans and measures. The "Monitoring, Analysing, Acting" system annually maps out the extent to which the integrated approach and participation have been achieved.

Integrated approach

The "Monitoring, Analysing, Acting" system distinguishes three ambition levels in terms of an integrated approach: setting integral goals; linkage with other taskings in the design and implementation of measures; and linkage through minor adjustments. In most cases, the elaboration and implementation of the regional Preferential Strategies involve linkage with other Delta Programme taskings (flood risk management, spatial adaptation, freshwater supply). In the area around the major rivers, the integrality ambitions are substantiated within the framework of Integrated River Management (IRM). For example, the IRM process also takes account of the impact of low discharges on the shipping sector. An integrated approach covering taskings beyond the scope of the Delta Programme – such as the circular economy, energy transitions, and mobility – usually involves higher ambitions: setting integral goals. This also extends to the individual measures level. This is because an integrated approach is the standard operating procedure in the Multi-Year Programme for Infrastructure, Spatial Planning and Transport (MIRT). For example, the IJsselkop MIRT Study has mapped out all the taskings in the focus area, both public taskings (nature, water quality, shipping, leisure activities) and private taskings (mineral extraction, economic activity).

With the introduction of the Environment Act, an integrated approach will be the point of departure. In virtually all cases, water issues are incorporated into other taskings, such as those pertaining to urbanisation, agriculture, the circular economy, nature, or energy. Governments are including integrated solutions in their Environmental Visions.

Participation

With respect to participation, the "Monitoring, Analysing, Acting" system distinguishes five ambition levels, in line

with the ladder of participation[5]: informing, consulting, advising, co-producing, and (co-)deciding. Co-producing is the ambition level most frequently opted for in the implementation of the regional Preferential Strategies. In particular in the Meuse, Southwest Delta, and IJsselmeer Region areas, participation has been structurally embedded in the procedures.

In terms of participation at the project level, ambitions in the past year were largely commensurable with those of the year before. Involvement in the preparation and realisation of individual projects differs sharply from one Delta Programme sub-programme to the next. To a significant extent, the project scope determines how participation is substantiated. Participation at the project level, therefore, presents a varied picture. For example, in the regional Preferential Strategy regarding the Rhine Estuary-Drechtsteden area, the "Optimisation of the Maeslant storm surge barrier" project has opted for informing, whilst the "Strategic adaptation agenda for the areas outside the dykes" project has opted for co-deciding.

[5] Edelenbos, J. and R. Monnikhof, 2001. Local interactive policy formation. A comparative study into the consequences of interactive policy formation for the functioning of the local democracy], Lemma, Utrecht.

Delta Programme valuation survey
In 2013, the Delta Programme Commissioner commissioned Erasmus University Rotterdam to survey how the delta community valued the Delta Programme, which elements in the Delta Programme were perceived as valuable, and what the Delta Programme had produced. In 2018, another survey was conducted, aimed at enabling the delta community to weigh in on the first six-year review of the Delta Decisions and regional Preferential Strategies. The participants were contacted during the Delta Conference, in tweets from the Delta Programme Commissioner, and through the Delta News newsletter. In the summer of 2019, the results (in Dutch) were published on the www.deltacommissaris.nl website.

2.2 Governance and embedding

Flood Risk Management Policy Platform
In 2019, the Flood Risk Management Policy Platform was set up, prompted by the need for more coordination and collaboration in flood risk management policy issues. The Flood Risk Management Policy Platform is an element of the Delta Programme governance structure, as are the Freshwater Administrative Platform and the Spatial Adaptation Steering Group. The Chair reports to and advises the Delta Programme Steering Group, and if need be, may place cases on the agenda of the Water Steering Group.

Embedding of review
Central government policy ensuing from the current Delta Decisions and Preferential Strategies of the Delta Programme is set down in the National Water Plan 2016-2021. This Water Plan thus constitutes the basis for the measures and provisions to be incorporated into the Delta Programme. The National Environmental Vision, which still awaits completion, will set out the strategic water policy (looking ahead to 2050), whilst the National Water Plan reflects the details of such policy and its translation into implementation strategies. The revisions and supplementations of central government policy ensuing from the review of the Delta Decisions and Preferential Strategies will be set down in the National Water Plan 2022-2027. This Water Plan will be established in accordance with the regulations of the Water Act, and will tie in with the policy set out by the National Environmental Vision. Under the interim provisions of the Environment Act, the Water Plan will subsequently be converted into several programmes: programmes that are mandatory by virtue of European guidelines, and for the remaining part, a national water programme.

Delta Programme embedding in provincial policy
In recent years, the provinces have embedded the Delta Decisions and Preferential Strategies (DP2015) in their policies, for the most part, in provincial water, environment, and spatial plans. Upon the introduction of the Environment Act, such policies will largely be set down in other ways. Several provinces have already adopted or are working on a Provincial Environmental Vision. In many cases, climate adaptation is one of the key taskings. Most of the Visions aim for an area-based approach, in interconnection with other provincial taskings in fields such as nature, agriculture, housing, and the energy transition. In the period ahead, the provinces will be exploring the best way to substantiate their ambitions through (inter-governmental) implementation programmes, investment programmes, collaboration agreements, and environmental regulations.

2.3 Knowledge and new developments

Information on studies focused on specific themes or regions is provided in Chapters 3 – 5. The studies are supplemented by the Sea Level Rise Knowledge Programme, which was recently launched as a result of the Deltares report on the potential impact of a rising sea level[6]. The information generated by this programme is of relevance to all the Delta Programme themes and regions. The new Top Sector Missions and the National Science Agenda open up opportunities to tackle delta issues in collaboration with other governments, research institutes, and the business community. Wherever possible, the Delta Programme links up such opportunities with the National Water and Climate Knowledge and Innovation Programme (NKWK).

Sea Level Rise Knowledge Programme

The Netherlands is the safest delta in the world and seeks to remain so in the future. The Delta Programme already comprises measures to protect the Netherlands against a rising sea level. As yet, insufficient information is available on how the sea level will develop beyond 2050, and on the measures that will be required and feasible. To cope with this uncertainty, the Sea Level Rise Knowledge Programme[7] will be launched in 2019, as an element of the Delta Programme.

Scientists from across the globe are investigating the extent to which and the pace at which the sea level will be rising. The Intergovernmental Panel on Climate Change (IPCC) is processing the results in global climate and sea level scenarios, which the Royal Netherlands Meteorological Institute KNMI will translate into scenarios for the Dutch situation. There is scientific consensus regarding these scenarios. Thus, they constitute a sound basis for the Delta Programme policies and Preferential Strategies. In the current KNMI climate scenarios (dating from 2014), the rise in sea level in the Netherlands ranges from 0.3 m to 1 m by 2100. For that reason, the Delta Programme is factoring in a maximum rise of 1 m by the end of this century. The IPCC is expected to publish a new report[8] in September 2019. The Minister of Infrastructure and Water Management will inform the House of Representatives on this report. The next KNMI climate scenarios will be ready by 2021. The Delta Scenarios will be updated accordingly.

In 2018, the Delta Programme Commissioner commissioned Deltares research institute to conduct an exploratory study into the potential impact of an accelerated rise in sea level on our flood defences, the coastal foundations, and the freshwater supply. According to the study, the rise in sea level could potentially accelerate with effect from 2050, entailing far-reaching consequences. This underscores the importance of gaining more insight into the potential acceleration and its impact, by developing knowledge and elaborating potential solutions. There is still sufficient time to do so. Thus, the Netherlands can remain the safest delta in the world, even after 2050.

For this reason, the Delta Programme partners are collaborating with the research institutes and representatives of the business community to prepare the Sea Level Rise Knowledge Programme. Wherever possible, they seek to link up with activities launched by other Ministries and with ongoing knowledge programmes. In April 2019, the Delta Programme Steering Group formulated the following goals for the Knowledge Programme:

- reducing the uncertainties regarding the developments on Antarctica and the associated rise in sea level;
- mapping out the extent to which the current Delta Decisions and Preferential Strategies are tenable and expandable in order to keep the coastal foundations, the flood defences, and the freshwater supply up to par when the sea level rises as expected;
- exploring potential action perspectives for the distant future and what short-term measures are required to keep options for the distant future open.

The Knowledge Programme will run until 2026. The outcomes will be used in the second six-year review of the Delta Programme, along with the periodically reviewed IPCC and KNMI scenarios. This will enable an adaptive response to a potentially accelerated rise in sea level beyond 2050, by amending the Delta Programme if need be.

The Sea Level Rise Knowledge Programme will be substantiated along five tracks:

I. Antarctica: what can we expect?
In the international collaborative efforts, the Netherlands will be contributing to fundamental research into Antarctica, based on our expertise and the significance for our delta: what mechanisms are at issue on Antarctica, how do they impact the pace of global sea level rise, and what will be the regional impact along our North Sea coast?

[6] Deltares (2019), Potential impact of accelerated rise in sea level on the Delta Programme, an exploratory study.

[7] Parliamentary Document 27 625, no. 472 (in Dutch).

[8] Special Report on Oceans and Cryosphere in a Changing Climate (SROCC).

II. System explorations: what is the tenability of the Preferential Strategies?
The Knowledge Programme will provide a better picture of what the different sea level scenarios entail for the performance of the natural (sandy) system of the coast and rivers, for the flood defences and engineering structures, for the freshwater supply, for utility functions, and for the use of space for purposes such as agriculture, nature, and shipping. And subsequently, which measures are conceivable and effective to boost the tenability of the Preferential Strategies.

III. Early warning system: how do we know when to act? The Delta Programme "Monitoring, Analysing, Acting" system will be elaborated further. A timely response to signs observed is important, because the realisation of measures takes considerable time. In this respect, it is essential not only to utilise local physical measurements – such as along the Dutch coast – and models, but also factor in other politico-administratively relevant signs, such as effects and measures elsewhere in the world.

IV. Alternatives and adaptation paths: action perspective for the distant future?
The Knowledge Programme also pays attention to uncertainties and scenarios for the distant future. After all, the sea level will continue to rise after 2100. This track commences with an analysis of the plans and initiatives that are already available: what lessons can be learned regarding potentially alternative strategies for the distant future? Opting for a single, specific solution strategy in the years ahead does not seem an obvious step. The study seeks to map out the no-regret options and measures that are required to keep promising options for the distant future open.

V. Implementation strategy
In addition to technical issues, the rising sea level also entails societal challenges. This track explores knowledge requirements relating to governance, communication, and transition management. What does the uncertainty regarding the rising sea level issue entail for the decision-making procedures? How do we create sufficient awareness among governments, NGOs, and the public? Is there support for measures that could be necessary in the decades ahead? How can we harness expertise and creativity in society? What can we learn from other transitions in terms of structuring the process?

The uncertainties regarding the distant future are still large. Consequently, for the time being, the focus will be on track I in order to reduce the uncertainties (in which respect the Netherlands will contribute its proportional share to fundamental, international research into Antarctica, based on our expertise and the specific significance for our delta), and particularly on Track II: how far does our current strategy extend, and what additional measures could be required and feasible in the decades ahead? It is important for the debate on any future, largely costly strategies and measures involved in Track IV to be underpinned by facts generated by Tracks I and II, wherever possible. That is why Track IV will initially focus on surveying existing plans and channelling new initiatives to keep flood risk management and freshwater supply up to par in the long run. The subsequent step is mapping out the no-regret options and measures to be proposed in the purview of the 2026 review, in order to keep potential options for the distant future open.

National Water and Climate Knowledge and Innovation Programme conference

The National Water and Climate Knowledge and Innovation Programme is celebrating its fifth anniversary this year. Under this programme, governments, businesses, and research institutes are collectively working on social issues relating to water and the climate. This makes it one of the most important knowledge programmes for the Delta Programme. The fifth anniversary conference took place on 14 May 2019. More than 400 participants – among whom 60 young people – attended workshops and field trips to become acquainted with the results of the programme in fields such as flood risk management, climate-proofing cities, the rise in sea level, soil management, European grants, drought, and soil subsidence. During the conference, 40 parties signed the Aquathermics Green Deal.

2.4 Market and innovation

With respect to all three Delta Programme issues, innovations constitute an important precondition for achieving the goals set for 2050. Under the heading of *Knowledge and Innovation*, paragraphs 3.1, 4.1, and 5.1 will outline recent developments.

Assisted by McKinsey, Rijkswaterstaat has conducted an analysis of the soil and civil engineering sector. The Minister of Infrastructure and Water Management submitted a memorandum on this analysis to the House of Representatives on 11 June 2019[9]. DP2021 will report on any impact this analysis may have on Delta Programme projects.

[9] Parliamentary Document 32 605, no. 217 (in Dutch).

Sustainable and climate-adaptive procurement and tendering

Procurement and tender procedures offer opportunities for contributing to climate adaptation and other taskings, in particular in the field of sustainability. Governments are harnessing several instruments in the purview of climate-conscious commissioning.

In the Duurzaam GWW 2.0 Green Deal [Green Deal for a sustainable soil and civil engineering sector], the district water boards, provinces, the central government, and other parties have agreed that by 2020, sustainability – including climate adaptation – will be structurally incorporated into all the soil and civil engineering projects. To this end, they have developed the Sustainable Soil and Civil Engineering strategy. This strategy comprises four instruments. The organisation can use the Environmental Compass to conduct a qualitative impact analysis and initiate a dialogue. The Ambition web presents the organisation's sustainability ambitions in a structured manner, and can also be used to visualise any ambitions of the project or programme. DuboCalc can be used to determine the sustainability of a design and the CO_2 Performance Ladder helps to select the most CO_2 conscious contractor.

In addition, the district water boards are using the Socially Responsible Procurement instrument to factor in how products, services, and structures will impact people, the environment, and prosperity.

2.5 International collaboration

Across the globe, a growing number of people are at risk of being hit by urban flooding, drought or water pollution. Currently, water – too much, too little or too dirty – plays a crucial role in ninety per cent of the natural disasters on Earth[10]. Expectations are that the problems will continue to grow. This calls for an international strategy to boost our resilience against climate change, improve our flood protection, and secure our water supply. The Netherlands is gaining considerable expertise and experience within the context of the Delta Programme, and regularly presents its delta approach to delegations from abroad.

[10] The Human Coast of Weather related Disasters 1995-2015 (UNISDR, 2015):"About 90% of all natural disasters are water-related. Over the period 1995–2015, floods accounted for 43% of all documented natural disasters, affecting 2.3 billion people, killing 157,000 and causing US$662 billion in damage."

Export of Delta Programme expertise

The Netherlands is the world's best protected delta. We have safeguarded our long-term strategy and adaptation to climate change through national policy, proper governance, collaboration with social parties, and innovations. The lessons that the Netherlands has learned in the Delta Programme are also of value to other countries, and the Netherlands is regularly requested to share its knowledge and expertise. The Delta Programme Commissioner's staff are contributing to the development and implementation of delta plans in Bangladesh, the Philippines, Vietnam, and other countries.

Updating of the International Water Ambition (IWA)

In the summer of 2019, the International Water Ambition was updated and submitted to the House of Representatives. The updated version is referred to as

the Netherlands International Water Ambition[11] (NIWA). Its updating has improved its alignment with Cabinet priorities and with topical water and climate ambitions. The new version only involves a minor change of course. The focus is still on deltas (flood risk management), cities (waterlogging), coastal plains (rising sea level and salinisation), and hinterland catchment areas. New emphasis is placed on a closer collaboration with the Ministry of Agriculture, Nature and Food Quality regarding food and water; multilateral collaboration; and boosting the catalyst function of the implementation agenda (trade and funding). The recommendations of the Global Center on Adaptation (GCA) and the Global Challenges report[12] underpin the international activities undertaken within the framework of the NIWA. Improving our resilience to the changing climate is a long-term project. This has resulted in a proposal to extend the NIWA term to 2030, which is also the horizon for the United Nations Sustainable Development Goals (SDGs).

Global Center on Adaptation

On 17 October 2018, former UN Secretary-General Ban Ki-Moon opened the Groningen office of the Global Center on Adaptation. Its sister office in Rotterdam had already been opened one month earlier, on 20 September. The GCA is an initiative of the Netherlands, Japan, the United Nations, and the World Bank. Its goal is to foster climate adaptation across the globe. In 2018, the Netherlands also initiated the *Global Commission on Adaptation*, along with sixteen other nations. The Commission consists of 30 members, originating from all over the world. They include several current and former government leaders, CEOs, and representatives of civil society. The Dutch Minister of Infrastructure and Water Management sits on the Commission. The *Global Commission on Adaptation* is chaired by Mr Ban Ki-Moon, Microsoft founder Mr Bill Gates, and World Bank CEO Ms Kristalina Georgieva. The Commission is supported by the Global Center on Adaptation and the World Resources Institute (WRI). The Delta Alliance (a collaborative of Delft University of Technology, WUR/ Wageningen Environmental Research, UNESCO-IHE, and Deltares) provides substantive contributions.
The Commission will present its first findings during the UN Climate Summit in September 2019. Its final report will be published during the Climate Adaptation Action Summit, which will be held in the Netherlands on 22 October 2020.

Special Envoys for International Water and Climate Affairs for the Kingdom of the Netherlands, and the Delta Programme Commissioner

The international activities of the Special Envoys for International Water and Climate Affairs for the Kingdom of the Netherlands have much ground in common with those of the Delta Programme Commissioner. The Special Envoy for Water Affairs advocates flood risk management and water security at the international level, and seeks to garner international political support for these issues. The Special Envoy for Climate Affairs pursues similar goals in the field of climate mitigation. The Delta Programme Commissioner focuses on national activities in the fields of flood risk management, freshwater supply, and spatial adaptation, but regularly showcases Dutch infrastructure projects to delegations from abroad. Every year, the Delta Programme Commissioner and the Special Envoy for Water Affairs visit an internationally relevant pilot project in the Netherlands together in order to exchange experience.

Blue Deal

The Blue Deal[13] (2018) is intended to provide 20 million people in 40 catchment areas across the globe with clean, sufficient, and safe water. The participating parties enter into long-term partnerships with water managing authorities abroad in the purview of implementing projects. The district water boards are closely involved in the Delta Programme; the Blue Deal is a practical way for them to transfer the expertise they have amassed to projects abroad. The Dutch parties also contribute the delta approach and their governance experience when it comes to water issues.

[11] Parliamentary Document 32 605, no. 217 (in Dutch).

[12] The Geography of Future Water Challenges – Planbureau voor de Leefomgeving, 2018.

[13] Collaborative of the Ministry of Foreign Affairs, the Ministry of Infrastructure and Water Management, and the district water boards, coordinated by the Association of Dutch Regional Water Authorities.

CHAPTER 3

Flood risk management: progress and measures

Wave run-up tests, Wadden Sea dyke between Oosterbierum and Sexbierum, November 2018

This chapter addresses the implementation of the Delta Decision on Flood Risk Management (Paragraph 3.1) and the progress of the measures set down in the Delta Plan on Flood Risk Management (Paragraph 3.2).

3.1 Delta Decision on Flood Risk Management

The essence of the Delta Decision on Flood Risk Management is that by no later than 2050, the probability of fatality due to flooding will be reduced to 1 in 100,000 per annum (.001%) or less for every resident living behind the dykes. Additional protection is provided in areas where there is potential for large numbers of victims or major economic damage, and in areas accommodating vital and vulnerable infrastructure of national significance. This is enabled by the new flood protection standards, which were anchored in legislation in 2017.

3.1.1 Progress in the implementation of the Delta Decision

The work on the Delta Decision on Flood Risk Management is proceeding according to schedule. Approx. 19 per cent of the primary flood defences have been assessed on the basis of the new standards and approx. 10 per cent of the dyke improvement projects carried out under the Flood Protection Programme (HWBP) are based on the new standards. The improvements that have already been completed and those that have been scheduled for the period up to and including 2027 will reduce the flood risk by some 50 per cent[14]. The dyke stretches posing the greatest risks are given priority in the Flood Protection Programme.

Solid statutory and financial basis

The Administrative Agreement on Water, the Water Act, and the Flood Protection Grants Scheme 2014 set out the statutory and financial frameworks for the Flood Protection Programme. In 2019, the central government and the district water boards will assess the efficiency and effects of the grants scheme on the basis of the experience gained in actual practice. The evaluation will commence in the second quarter and the report will be completed by the end of 2019. The assessment comprises two phases: first, an analysis of all the grants awarded in order to draw a conclusion regarding the efficiency of the scheme, and subsequently, an in-depth analysis covering a minimum of fifteen projects in order to map out the overall grants process and its effects. In early 2020, the House of Representatives will be informed of the outcomes and any amendments to the grants scheme as prompted by the evaluation.

By 2023, we will have greater clarity regarding the scope of the flood risk management tasking, when the Minister of Infrastructure and Water Management, as stipulated in the Water Act, reports to the Senate and the House of Representatives on the condition of the primary flood defence systems on the basis of the national round of assessments. Subsequently, the agreements set down in the Administrative Agreement on Water will be reviewed.

Assessment: on the road to the first picture of national security

The Statutory Assessment Tools (WBI 2017) enable flood defence system managers to assess whether the primary flood defences meet the statutory requirements. The First National Assessment Round commenced in early 2017 and is aimed at compiling a first nationwide security picture by 2023. The assessments are on schedule, but the implementation of the flood probability approach and the new assessment tools requires a great deal of effort on the part of the managers. By mid-2019, assessments were completed for 663 km of primary dykes, i.e., some 19 per cent of the primary flood defence systems. High-risk dykes have been assessed first.

The collaboration between the district water boards and the Ministry of Infrastructure and Water Management (including Rijkswaterstaat) is proceeding well: the organisations are exchanging expertise and are collectively gaining experience with the flood probability approach.

The public Flood Risk Management portal features a map showing the progress made with the assessment of dyke sections. Since the end of 2018, security scores have been colour coded on the map; it also shows the scope and schedule for the dyke improvements under the Flood Protection Programme.

Instruments for the assessment and design of flood defence systems

The last major amendment to the Statutory Assessment Tools (WBI 2017) was effected at the end of 2018. The tools now enable completion of the first round of assessments. The amendments have been set down in close consultation with the parties using the tools. A dyke manager will take action if an assessment shows that a primary dyke fails

[14] Source: memorandum on monitoring of flood risk management target attainment, Deltares, June 2018.

to meet the standards. In accordance with the Water Act, the Minister will also draw up technical guidelines for the design, management, and maintenance of primary flood defences. Application of the guidelines by the dyke managers is recommended. In 2019, several items in the Technical Guidelines will be updated, and the new Designing with Flood Probabilities Manual will become available. The manual is based on the practical experience and recommendations of the Risk-based Approach Knowledge Platform.

In collaboration with Deltares, the Ministry of Infrastructure and Water Management has developed a methodology for capitalising on the experience of experts in Tailored Assessments. Within the Knowledge and Expertise Platform set up by the Foundation for Applied Water Research STOWA, flood defence system managers and private sector parties have developed several Tailored Assessment approaches. District water boards have field-tested the method in several pilot projects. In 2019, a study will be conducted to explore the wide-scale application of the method in the assessment and design of flood defence systems. The assessment and design tools will be developed further under the BOI[15] 2023 programme. BOI 2023 is the instrument to be used for the next round of assessments, which will commence in 2023. The instrument is based on the current assessment tools (WBI 2017), design tools (OI 2014), and Technical Guidelines, supplemented with new expertise and functionalities. The new tools thus tie in with the current knowledge and practical experience gained in the first round of assessments.

Efficient containment of flood risks involves the entire chain of assessment, design, improvement, management, maintenance (duty of care), and information exchange. In the period ahead, the experience gained by the managers in the first national round of assessments and the Flood Protection Programme will be used to optimise procedures throughout the chain. This will not only improve the tools, but also enhance their application and the system as a whole. The point of departure in this respect is critical assessment and realistic design, in order to ensure efficient containment of flood risks.

Integrated River Management programme

In the Rhine tributaries and the Meuse, several major national and regional taskings converge. The taskings incumbent upon the central government involve flood risk management, shipping, ecological water quality, nature, the freshwater supply, and riverbed management. The regional taskings pertain to domains such as nature, leisure activities, the economy, and appealing residential and business climates. Spatial adaptation is another issue requiring attention. The taskings pertain to both high and low water level situations. Climate change (larger discharge volumes and longer periods of drought) and summer bed erosion are adding to some taskings and generating new taskings.

That is why, in 2018, the Minister of Infrastructure and Water Management expressed her intention to set up an Integrated River Management (IRM) programme in collaboration with government bodies, the business community, and NGOs in the areas around the major rivers. On 4 July 2019, the Minister set down collective agreements with the administrators of the Rhine and Meuse regional Delta Programmes, and commissioned the launch of the Integrated River Management programme. An Integrated River Management (IRM) steering group will be set up to carry out this task. The steering group will comprise representatives of the central government, the regions, and the staff of the Delta Programme Commissioner.

The governments involved agree that it is important to view the river as a single system and adopt an integrated approach to the taskings. They regard flood risk management as a prerequisite for addressing other taskings, in which respect river widening and spatial planning open up opportunities for interconnecting multiple river system taskings. The IRM steering group has been tasked with substantiating a more integrated approach to the future of the area around the major rivers, following three tracks. These tracks are:

- Policy development;
  In 2019 and 2020, the parties will be working on a comprehensive perspective of the future of the river system. Furthermore, some policy choices will be prepared. Thus, they will also be substantiating the review of the Preferential Strategies for the rivers Rhine and Meuse. The aim is to set down the policy choices in a policy framework by 2021.
- Developing a working method;
  In 2018, the parties surveyed which taskings are relevant to IRM. In addition, the governments will further flesh out the integrated approach by drawing up a collective assessment framework, within the IRM programme, to underpin the selection of taskings to be addressed.
- Preparing implementation decisions;
  Projects ensuing from the implementation of IRM can be accommodated in the Delta Programme or in existing implementation programmes. Some may be accommodated in a new IRM implementation programme.

The steering group will embark on its task in September 2019, following its first meeting.

A sum of 375 million euros from the Delta Fund has been set aside for IRM projects to be implemented in the period

[15] Assessment and Design Tools.

2029-2031; subsequently, an annual sum of 80 million euros will be available with effect from 2032. Additional resources will be allocated from the Major Waters Programme Strategy budget (see text box). Supplementary funding will be sought from other national and regional resources, in accordance with the goals fostered by IRM.

Several river widening explorations are underway for the rivers Meuse and Rhine. The aim is to complete the projects by 2028. In the purview of IRM, the parties are going to assess river widening and other measures for the period beyond that on the basis of the assessment framework that has been developed.

Major Waters Programme Strategy

In 2018, the Minister of Infrastructure and Water Management and the Minister of Agriculture, Nature and Food Quality rolled out the Major Waters Programme Strategy. Under this strategy, which covers the period up to and including 2050, they intend to implement, in consultation with regional authorities, 33 spatial planning measures that are needed to future-proof the major waters and sustain high-grade nature that is conducive to a robust economy. The measures pertain to the Southwest Delta, the IJsselmeer Region, the Eems-Dollard, the Wadden Sea, and the rivers Rhine and Meuse. The measures will be implemented at different times. The first areas to be tackled, in 2018, were the Grevelingen, IJsselmeer, and Eems-Dollard areas, using 95 million euros from the coalition agreement. The Cabinet has set aside 248 million euros for the period up to and including 2032. The regional authorities will make additional resources available; concrete details on the budget have not yet been provided. The Cabinet has mapped out a set of 14 measures, costing some 580 million euros. This set also comprises measures aimed at expanding low-dynamic river environments (such as swamp areas), at combating structural river channel erosion, and at combating winter bed dehydration. In 2019, these river measures will be coordinated with the regions within the context of the Integrated River Management and Major Waters Programme Strategy programmes. Details regarding the national and regional budgets available will be provided by the end of 2019, as will details regarding the programmes under which the measures will be addressed. On this basis, the Ministers will decide on the use of the 248 million euros set aside for the Major Waters Programme Strategy. Wherever needed and feasible, the implementation of Major Waters measures will be coordinated with the ongoing Water Framework Directive Improvement Programme and the Natura 2000 management plans.

Flood Risk Management Policy Platform

Recent years have seen the need arise for increased coordination and collaboration regarding flood risk management policy issues. Accordingly, at the end of 2018, the Delta Programme Steering Group expressed its support for the establishment of the Flood Risk Management Policy Platform. The Flood Risk Management Policy Platform focuses on short-term and long-term national flood risk management policy. Its aim is to further develop national flood risk management policy in interaction with the regional elaboration and implementation of actual measures. Policy-related topics ensuing from implementation programmes, such as the Flood Protection Programme, will also be addressed.

The agenda of the Flood Risk Management Policy Platform features topics relating to the various components of flood risk management policy, with an eye to their interfaces with spatial taskings (incorporation, linkage). Cases in point are the long-term strategy for coping with the rise in sea level; the review of the Delta Decision on Flood Risk Management; the evaluation of the Water Act in 2023; flood risk management in relation to the National Environmental Vision; the assessment and design tools for flood defence systems (WBI and OI); and the national Flood Risk Management Knowledge Agenda.

The Flood Risk Management Policy Platform focuses on:

- enabling the key stakeholders to provide advice to the Minister of Infrastructure and Water Management (who bears final responsibility for flood risk management policy), preferably at an early stage of such policy development;
- providing advice to the Delta Programme Commissioner and the Delta Programme Steering Group, for example, regarding the interconnectivity between flood risk management and the other themes and regional Preferential Strategies, and regarding the annual proposal for the Delta Programme;
- garnering commitment to, and support for, short-term and long-term national flood risk management policy among the partners;
- ensuring a proper liaison between policy and the knowledge community.

The Flood Risk Management Policy Platform is an element of the Delta Programme governance structure. The Chair reports to the Delta Programme Steering Group and, if

so desired, can place issues on the agenda of the Water Steering Group. The Flood Risk Management Policy Platform participants are representatives of the Ministry of Infrastructure and Water Management; the Association of Dutch Regional Water Authorities; the Association of Provincial Authorities; the Association of Netherlands Municipalities; and the Staff of the Delta Programme Commissioner. Other partners and stakeholders participate as agenda members; they are invited if so relevant to a substantive discussion or coordination. The agenda members include representatives of several other Ministries [16]and the Chairs of regional and theme-based Delta Programme steering groups.

Flood impact reduction

In addition to pursuing adequate flood protection, the Delta Programme also aims to contain the damage and casualties caused by floods. However small the probability of flooding, a flood will have a major impact. Smart spatial planning and disaster control choices can contain such an impact. The topic of flood impact reduction through spatial planning has been elaborated in the Delta Plan on Spatial Adaptation (5.1.1.).

Disaster control

The Security Regions are using the outcomes of the Water and Evacuation project, completed in 2017 to continue to prepare for flooding. The WAVE2020 programme – a Dutch abbreviation that stands for Water Crises Control in Security Regions – is intended to improve flood disaster control and coordinate relevant efforts expended by the 25 Security Regions. Most of the impact analyses were completed in 2019. Their outcomes will serve as the basis for the definition of regional action perspectives, such as preventative evacuation or taking shelter. The formulation of the impact analyses and action perspectives by the individual Security Regions and their partners is taking more time than has been scheduled. Furthermore, it is becoming increasingly clear that the impact of a flood on hubs of economic activity, on vital infrastructure or on densely populated areas could result in a national crisis. This means that the Security Regions will also need to prepare for societal continuity in the event of a flood hitting territories other than their own.

The WAVE2020 programme is compiling the outcomes of the impact analyses and the action perspective strategies into a single national picture, to underpin a new contingency plan for all the governments to control the impact of a flood. This plan will evolve over the next few years. Several guidelines are helpful in this respect. The "Evacuation of people, livestock, and goods" guidelines will be available in 2019 in the purview of regional and national evacuation plans. Other guidelines pertain to "rescue operations" and "restoration and continuity of society". In addition, the programme is working on a more efficient exchange of information between the various organisations responsible, in order to ensure that all will have the same information during a crisis and during the preparation stage. The Water Crises and Floods Management Steering Group has commissioned the WAVE2020 programme, which involves collaboration between the Security Regions, district water boards, Rijkswaterstaat, and the relevant Ministries.

A symposium held on 4 April 2019 focused on administrative control in the event of a flood hitting the Randstad conurbation. The symposium was a component of the continuous preparation for the coordination during (imminent) flooding and containing the impact of a flood. A water crisis requires administrators to join forces. In such cases, it is important that all the parties know how to get in touch with one another. During the symposium, the administrators involved signed the collective declaration of intent regarding Randstad flood disaster control.

The essence of the declaration is that district water boards 1) raise water awareness and factor in water-related opportunities and risks in their work; 2) collaborate on impact analyses and action perspectives in order to ensure maximum efficiency in their response to an (imminent) flood in the Randstad conurbation; and 3) improve the integrality of the coordination between the regional and national strategies for combating flood disasters.
The administrators thus endorse their collaboration and the multi-layer flood risk management approach as initiated in the Delta Programme.

Duty of care audit

Since 2014, responsibility for the supervision of the primary flood defences has been vested with the Minister of Infrastructure and Water Management. The supervision is exercised by the Human Environment and Transport Inspectorate (ILT). In 2017 and 2018, the ILT audited all the district water boards and Rijkswaterstaat in order to gain a picture of how these managers are substantiating and implementing their duty of care regarding the primary flood defences. The ILT will present the outcomes of this audit to the Minister in the autumn of 2019.

3.1.2 Potential amendment of Delta Decisions

DP2021 will comprise proposals for the review of the Delta Decisions and regional Preferential Strategies. As a first step, the potential amendments are mapped out in the DP2020 before you. Chapter 2 outlines the process.

The Delta Decision on Flood Risk Management is to ensure

[16] The Interior and Kingdom Relations; Agriculture, Nature and Food Quality; Economic Affairs and Climate Policy; Justice and Security.

that by 2050, the primary flood defences will be up to standard. Several underlying goals have meanwhile been attained: the new standards founded on the risk-based approach have been anchored in legislation (2017); the associated Statutory Assessment Tools (WBI2017) have been completed; the first national round of assessments based on the new standards is underway; and the finalisation of the assessment and design tools (BOI 2023) has been initiated. The Flood Protection Programme sets out the dyke improvement schedule up to and including 2025, fitting within the annually available budgets.

Other underlying goals have been placed on the agenda for the years ahead. At the end of 2023, the Minister of Infrastructure and Water Management will report to the Senate and the House of Representatives on the condition of the primary dykes, on the basis of the outcomes of the national round of assessments. By the end of 2024, the Minister will report on the efficiency and effects of the new flood risk management policy. In accordance with the Water Act, the authorities will then also evaluate whether any vital changes in underlying assumptions dictate adjustment of the standards.

According to the analysis of new developments (see Background Document A), currently there is no reason to amend the Delta Decision on Flood Risk Management.

In line with the advisory report of the Signal Group, a sensitivity analysis will be conducted in 2019 into the significance of the housing tasking for the Delta Decision on Flood Risk Management, within the context of the review. The results will be presented in DP2021 and will constitute input for the evaluation of flood risk management policy (2024).

3.1.3 Knowledge and innovation

Adequate and timely substantiation of the flood risk management tasking requires specific research and innovations, supplementary to the knowledge that is developed throughout the Delta Programme (see Paragraph 2.3). This theme-specific knowledge is primarily gathered through the knowledge programmes initiated by the Ministry of Infrastructure and Water Management, and by the knowledge and innovation programme of the Flood Protection Programme (see Paragraph 3.2.1), which also covers the General Explorations.

Knowledge programmes

The Ministry of Infrastructure and Water Management launched its Flood Risk Management knowledge programme on 1 January 2018. Its aim is to keep knowledge of flood risk management up to par, as a basis for effective and practicable policy. The knowledge programme is updated annually, with input from government bodies, the business community, and research institutes active in the flood risk management sector. The programme features three pillars: Technology, System, and the Environment.

- Technology: knowledge required to optimise the Statutory Assessment Tools (WBI) for the primary flood defences, and to update guidelines and technical reports regarding their assessment. The 2019 knowledge programme features studies into failure mechanisms of primary flood defences (macrostabiliy, piping, and hydraulic loads caused by water levels and waves).
- System: the current knowledge programme features studies into the behaviour of coastal systems (Coastal Genesis 2.0) and river systems (Rivers2Morrow).
- The Environment: this covers studies into environmental factors affecting flood risk management policy, such as evacuation and risks of casualties. The schedule features studies into climate change and sea level rise and studies into waterlogging.

Consultation and coordination regarding the focus areas in the Flood Risk Management Knowledge Programme take place within the National Water and Climate Knowledge Programme. The central government and district water boards are coordinating their knowledge agendas to foster the efficiency of their efforts, and are promoting the practical application of the knowledge amassed.

The Delta Fund provides structural funding for the knowledge programmes. This enables the studies to link up with the long-term schedules of other parties, such as the Netherlands Organisation for Scientific Research / Applied and Engineering Sciences division.

3.2 Delta Plan on Flood Risk Management: measures to protect the Netherlands from flooding

The Delta Plan on Flood Risk Management comprises all the Delta Programme studies, measures and provisions, scheduled or to be scheduled, pertaining to flood risk management. The measures are funded from the Delta Fund, and, in some cases, from the Ministry of Infrastructure and the Environment budget. Where appropriate, the Delta Plan on Flood Risk Management also features regional measures not subsidised by the central government.

Every year, the Delta Programme Commissioner submits a proposal for the Delta Programme, which includes the Delta Plans. The Delta Plans comprise studies, measures, and provisions in the fields of flood risk management, spatial adaptation, and freshwater supply in the Netherlands. The proposal contains a detailed schedule for the first six years and an indicative schedule for the subsequent six years. It looks ahead to 2050 (in accordance with Art. 4.9 paragraph 5 of the Water Act).

The Delta Plan on Flood Risk Management, as outlined below, features diagrams and tables reflecting the progress, scheduling, planning, and phasing of the flood risk management projects

3.2.1 Implementation programmes

Flood Protection Programme

The Flood Protection Programme is going full steam ahead. Many dyke improvement projects scheduled under the programme have been launched in recent years and are now being implemented. Several projects involve more safety tasking than was expected when these improvement projects were incorporated into the programme.
The implementation alliance is monitoring further developments. The round of dyke assessments according to the new standards will be completed by 2023. In the years ahead, the assessments will provide an increasingly better picture of the overall scope of the programme until 2050.

Evolving programme

The Flood Protection Programme is an ongoing programme; the measures are scheduled for a period of six years, with a tentative schedule for the following six years. The programme is aimed at having all primary flood defence systems meet the new standards by 2050. This will ensure a minimum protection level of 1 in 100,000 (0.001%) per annum for every resident of the Netherlands living behind a primary dyke or dam by no later than 2050. The Flood Protection Programme is drawn up collectively by the implementation alliance of the district water boards and Rijkswaterstaat. Dyke improvements are carried out by the manager of the dyke sections concerned, to which end a grant is provided from the Flood Protection Programme covering 90% of the cost, based on an efficient, plain and simple design. Every year, the alliance will propose a new schedule, that builds on the preceding year's schedule (evolving programme). The Minister of Infrastructure and Water Management sets down the programme once a year within the context of the Delta Plan on Flood Risk Management.

Dyke improvements impact the environment. That is why stakeholders are being involved in projects at the earliest possible stage. Local and regional governments play a formal role in this respect. For example, municipalities play a role on account of their responsibility for local spatial planning (municipalities) and the environment, regional area developments, and nature (provinces). For every dyke improvement project, the district water board responsible draws up a Water Act Project Plan, which requires approval from the Provincial Executive.

In addition, it is incumbent upon the municipalities and provinces to capitalise on opportunities for linkage with other taskings and ambitions in an area. To this end, DP2015 stipulates that the district water boards will submit the draft Flood Protection Programme schedule during the annual Delta Programme regional consultation committee meetings. This enables the consultative bodies to identify linkage opportunities, and review whether the longer run will open up opportunities for comprehensive, combined solutions that could constitute an alternative to regular dyke improvement. With effect from 2019, the draft schedule proposal and the final schedule proposal will be produced earlier in the year. This affords the regional consultative bodies more time to identify such opportunities. Actual practice sees continuous administrative coordination regarding the dyke improvement projects and the associated spatial developments. Ergo, linkage opportunities are identified throughout the year.

New projects in the programme

New projects will only be incorporated into the Flood

Protection Programme if they meet the new standards. The schedule for 2020-2025 features new projects ensuing from the first (partial) assessment of flood defence systems according to the new standards: a total of forty new projects. These projects have been accommodated in the programme on a basis of urgency. Up until mid-2020, the schedule features both dyke improvements ensuing from the previous round of assessments under the old standards (the extended third round, covering measures that are largely in progress) and increasingly more dyke improvements based on the first round of assessments involving the new standards. The dyke improvements ensuing from an assessment under the old standards will be dimensioned in accordance with the new standards.

From now on, the schedule will also feature exchange contributions to river widening projects (avoided costs of dyke improvements). This year's schedule reflects such contributions for four projects, fostering a powerful interaction between dyke improvement and river widening (see Table 4).

Dyke improvement in kilometres per annum

By 2050, all flood defence systems must meet the flood protection standard. The Flood Protection Programme covers the improvement of 927 kilometres of dykes and 468 engineering structures. In the years ahead, the programme will be substantiated in more detail on the basis of the outcomes of the assessments.

Figures 1 and 2 provide a prognosis regarding the improvement of dykes and engineering structures. Both figures show that the number of completed improvement projects will be increasing sharply after 2023. The Flood Protection Programme alliance partners are working on smart and broadly supported solutions. The aim is to shorten the lead time of dyke improvement projects and reduce the price per kilometre.

The vast majority of the Flood Protection Programme projects are still in the exploration and plan elaboration stages. Consequently, their scope and scheduling have not fully crystallised. In the years ahead, increasingly more projects will be entering the realisation stage. The goal of the Flood Protection Programme is to grow towards an average realisation volume of 50 kilometres of "safe dykes" per annum. The programme will run until 2050; the ambition is to have attained the goal of "all primary flood defences in the Netherlands meeting the (new) protection standard" by that year.

In the current programme, the schedule for the years 2020 and 2021 has been adjusted vis-à-vis last year in terms of the realisation of "kilometres of safe dykes". This adjustment is related to the longer lead times of the exploration and plan elaboration stages of several projects. Some projects turned out more complex than was assumed, other projects have been combined into larger projects involving longer lead times. One of the consequences of anticipating the transition from the old to the new standards is longer exploration stages. In the current schedule, the managers have incorporated more realistic planning with respect to project lead times, rather than observe the standard lead times for project stages.

However minor, this setback has the full attention of the alliance in order to boost their control in collaboration with the managers. According to current insights, this delay will not impact the programme goals. In the period beyond 2021, a realisation of considerably more than 50 kilometres per annum is foreseen for a number of years.

The number of kilometres of dyke improvement realised up to and including 2018 has been adjusted upwards vis-à-vis earlier forecasts. Rejected kilometres that, following a more detailed safety analysis, could be declared safe without any physical measures have now been counted as well.

A new system is being developed to monitor the progress made with respect to the improvement of engineering structures under the Flood Protection Programme. This will be accommodated in DP2021. Consequently, for this year only, the forecast is based on the state of affairs on 31 December of the year before.

Continued development

Now that increasingly more projects are entering the plan elaboration and realisation stages, the Flood Protection Programme will be embarking on a new phase, which will entail new requirements for the alliance collaboration. The "Continued Development of the Flood Protection Programme" change process is addressing such requirements. The change process was established in 2018-2019 on the basis of six tracks, which has resulted in Alliance Principles and the Flood Protection Programme Schedule 2019-2023. The Alliance Principles, which have been set down at the administrative level, substantiate the collaboration in more detail. The programme schedule details the substantive development of the Flood Protection Programme: the manner in which collaboration between the projects and the programme is being fleshed out, the evolution of the Programme Management primary processes (such as awarding grants), and the priority themes and tasks addressed by the alliance (such as innovation). During the *Dijkwerkersdag* [Dyke Workers Day] on 11 April 2019, all the flood risk management portfolio holders of the district water boards and Rijkswaterstaat signed the Alliance Principles of the Flood Protection Programme, as did the Association of Dutch Regional Water Authorities.

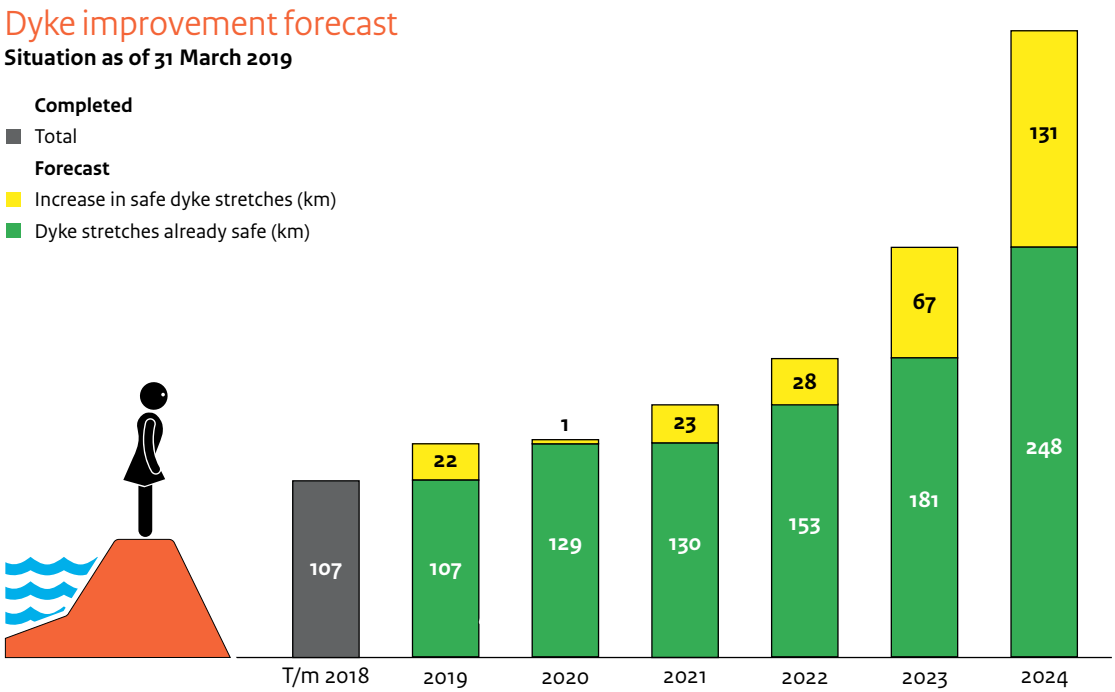


Figure 1 *Forecast for dyke improvements implemented under the Flood Protection Programme, in kilometres. Data pertaining to the period 2019-2024 is based on the "dyke safe" conclusions. State of affairs on 31 March 2019.*

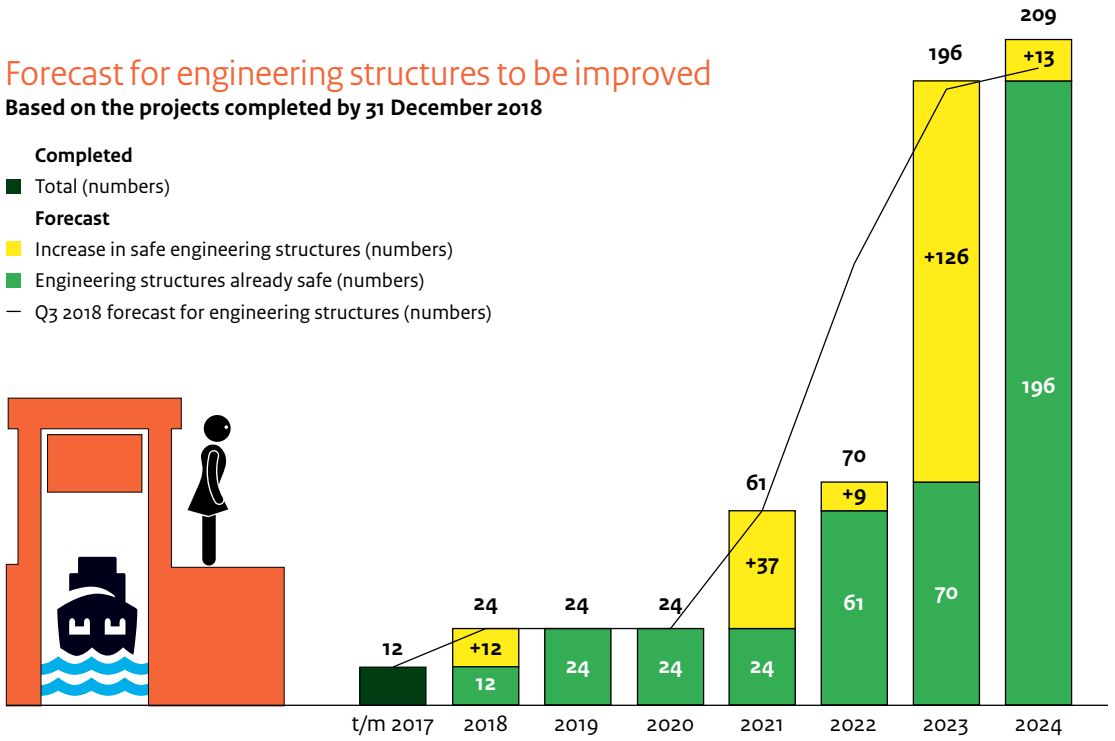


Figure 2 *Forecast for improvements to engineering structures implemented under the Flood Protection Programme in the years 2019-2024. Data up to and including 2018 is based on the projects completed by 31 December 2018.*

Alliance Principles

Collaboration between the alliance partners is based on the following collective principles:

1. Best for Programme: we act in the interest of the alliance as a whole, and we work in concert on socially optimal solutions to flood risk management.
2. Solidary: we collectively contribute to the funding and implementation of dyke improvements, regardless of our individual interests. We are equal and jointly responsible.
3. True to our respective roles: we play different roles within the Flood Protection Programme (implementation, funding, supervision, drawing up frameworks), which we sometimes combine. We are true to our roles in the interests that we serve.
4. Transparent: we are open towards one another; any conflict between our individual interests and our collective interests will be discussed.
5. Predictable and without any surprises: risks and issues will be discussed at an early stage; this enables us to set an appropriate course and make careful decisions.
6. Reliable: we set down transparent agreements with one another and meet our commitments.

We are working in accordance with these collective principles, and if need be we will hold each other to account.
We help one another wherever possible, by sharing our expertise and experience.
We collectively propagate the significance of the Flood Protection Programme.
We regularly assess – as a minimum, once every two years – our collaboration and these principles.

Table 1: Delta Plan on Flood Risk Management – Schedule of measures

Flood Protection Programme			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
2020-2033 Programme budget series			287	447	375	514	545	591						
No. on the map	**Project no.**	**Project name**												
201	22AR	Fort Everdingen-Ameide Sluis												
202	22AQ	Ameide-Streefkerk												
203	22W	Vianen												
204	25Q	Grebbe dyke												
205	22D	Neder-Betuwe												
206	24AV	Zuid-Beveland West, Hansweert S1												
207	05C	Gouda IJssel dyke (Phase 2)												
208	05E	Gouda IJssel dyke improvement (VIJG) Track 2												
209	02B	Waaiersluis te Gouda												
210	22AW	Sprok-Sterreschans (Kop van Betuwe)												
211	22AI	Wolferen-Sprok (including De Stelt)												
212	22K	City of Tiel												
213	22X	Gorinchem-Waardenburg (GoWa)												
214	22Y	Tiel-Waardenburg (TiWa)												
215	16M	Geervliet-Hekelingen 20-3												
216	16E	V3T flow slide												
217	02D	Strong Lek Dyke: Wijk bij Duurstede-Amerongen												

Key: Study Exploration Plan elaboration Realisation

Flood Protection Programme			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
2020-2033 Programme budget series			287	447	375	514	545	591						
No. on the map	**Project no.**	**Project name**												
218	02F	Strong Lek Dyke: Culemborg Ferry - Beatrix Locks												
219	02I	Strong Lek Dyke: Irene Locks - Culemborg Ferry												
220	22AU	Sterreschans-Heteren												
221	13N	Ravenstein-Lith												
222	24AH	Zuid-Beveland West, Westerschelde S2												
223	24AO	Zuid-Beveland West, Westerschelde S3												
224	06K	Krimpenerwaard Robust IJssel Dykes (KIJK)												
225	80K	SVK Hollandse IJssel storm surge barrier (gate)												
226	13K	Cuijk-Ravenstein												
227	02E	Strong Lek Dyke - Salmsteke												
228	02H	Strong Lek Dyke: Klaphek - Jaarsveld												
229	02G	Strong Lek Dyke: Salmsteke - Schoonhoven												
230	34U	Zwolle-Olst												
231	34M	Zwolle												
232	34R	Zwolle flood gate												
233	34AN	Vecht-Zwolle												
234	34AR	Vecht-Oost												
235	22AT	Gameren												
236	34AP	Vecht-Dalfsen west												
237	34AK	Vecht-Stenendijk Hasselt												
238	80F	IJmuiden												
239	34O	Mastenbroek IJssel												
240	13H	Boxmeer - Cuijk (part)												
241	24AQ	Zuid Beveland Canal												
242	24AP	Zuid-Beveland Oost, Oosterschelde (2)												
243	24R	Zuid-Beveland Oost, Westerschelde												
244	34P	Mastenbroek Zwarte Meer												
245	34L	Genemuiden-Hasselt												
246	34AL	Vecht Zwartewaterland												
247	34Q	Mastenbroek Zwarte Water												
248	28F	Koehool-Lauwersmeer												
249	18D	Lauwersmeer/Vierhuizergat												
250	28H	Lauwersmeer dyke												
251	27E	IJsselmeer dyke												

Key: Study Exploration Plan elaboration Realisation

Flood Protection Programme			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
2020-2033 Programme budget series			287	447	375	514	545	591						
No. on the map	**Project no.**	**Project name**												
252	25K	Apeldoorns Canal IJssel dyke												
253	03O	Den Oever-Den Helder (vm WAB)												
254	80G	Vlieland												
255	03V	Engineering structures												
256	80L	Marken												
257	25L	Northern Randmeer dyke												
258	02C	Improvement of former C-dyke HDSR												
259	03E	Wieringermeer storm surge barrier												
260	03I	Noordzee Canal (D31 - D37)												
261	05F	Spaarndammer dyke engineering structures												
262	05G	Gouda IJssel dyke improvement, track 4 (GHIJ)												
263	80B	Drongelens Canal (P52)												
		Improvement of former C-dyke RWS												
264	80A	Bosscherveld locks												

Key: Study Exploration Plan elaboration Realisation

Table 2: Measures set out in the Administrative Agreement on the Meuse

Administrative Agreement on the Meuse*		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
No. on the map	**Project name**												
331	Round 1												
331	Round 2												
331	Round 3												
332	Baarlo												
333	Venlo Velden and Blerick Groot Boller												

Key: Study Exploration Plan elaboration Realisation

*The acceleration in the projects being conducted under the Administrative Agreement on the Meuse revolves around the combined completion of the exploration, plan elaboration, and realisation phases of the dyke improvements. With the exception of the dyke improvements scheduled for Blerick, near the old foundry (19C) and Steyl-Maashoek (19D), the dyke improvements are now being elaborated in a single comprehensive exploration. Separate timeframes and cost estimates will be drawn up for the realisation of each of the projects.
The first round involves the following dyke sections: 60J Nieuw Bergen, 60M Belfeld, 60L Beesel, and 60E Heel. The realisation phase will be divided across 2020 and 2021.
The second round involves the following dyke sections: 60T Alexanderhaven (the budget for stretches 23A and B of this section has been allocated in full), 60B Steyl-Maashoek, and 60K
Buggenum (the amount for Alexanderhaven plan elaboration covers the exploration and plan elaboration).
The third round involves the following dyke sections: 60G Well, 60F Arcen, and 60D Thorn. Part of the realisation phase will be settled after completion, as the budget for 2021-2023 is insufficient. Payment has now been scheduled for the years after 2024.
The Venlo-Velden and Groot Boller projects involve dyke sections 60H Venlo-Velden and 60O Blerick Groot Boller. The Venlo and Boller projects involve system measures being implemented under the Multi-Year Programme for Infrastructure, Spatial Planning and Transport (MIRT).

Table 3: Reserve for pre-financing

Reserve for pre-financing			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
No. on the map	**Project no.**	**Project name**												
350	24AK, 24AJ, 24AR	Sint Annaland/Kop van Ossenisse						€		€				
351	17D	Kerkhovenpolder-Germany							€		€		€	€
352	14A	Geertruidenberg/Amertak						€		€	€			
353	04A	Spuihaven Schiedam		€										
354	21A	Rijnkade			€			€		€				
355	21I	IJsselpaviljoen			€									
356	21F	Twente Canal - regular section -			€									
357	21E	Gruthoek industrial estate							€	€				
358	03R	Gouwzee & Buiten IJ		€				€		€		€	€	€
359	03S	Markermeer dyke connection	€											
360	03Y	Durgerdam connection	€											
361	06H	Stolwijk lock		€										
362		Sasse pumping station					€							
363		Maasboulevard Cuijk					€							
364	60AE	Lob van Gennep							€	€	€	€	€	€
365	21AJ	DR 50 South side of Twente Canal							€					
366	21AK	DR 50 RIDS Zutphen embankment constructions							€					

Table 4: River widening – dyke improvement exchange contributions

River widening – dyke improvement exchange contribution	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Project name												
MIRT Lob van Gennep							€					
Meuse embankment park								€				
Oeffelt									€			
IJsselpoort										€		

Table 5: Tentative schedule for 2026-2031

Tentative schedule for 2026-2031			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
No. on the map	**Project no.**	**Project name**												
601	06F	Remainder of Hollandse IJssel tasking												
602	13S	's-Hertogenbosch-Heusden												
603	21AI	Spijk-Westervoort												
604	22BJ	Everdingen-Ravenswaaij												

Tentative schedule for 2026-2031			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
No. on the map	**Project no.**	**Project name**												
605	22BK	Heerewaardense Afsluitdijk												
606	22BI	Gorinchem-Sliedrecht												
607		Vecht Dalfsen west connections												
608		Vecht Zwolle connections												
609	22BL	Sliedrecht-Kinderdijk												
610	13P	Lith-'s-Hertogenbosch												
611	24AT	Sloehaven to Buitenhaven, remainder of N29-3												
612	14D	Willemstad stretch												
613	17E	Kerkhovenpolder-Germany												
614	27F	IJmeer dyke-Almere Poort												
615	03L	Den Helder sea wall												
616	03Z	Nieuw Diep (Den Helder)												
617	3O	WAB connections												
618	21F	Twente Canal												
619	24H	Sloehaven tot Buitenhaven, rest N29-3												
		Willemstad stretch												
620		Millingen aan de Rijn												
621		Ewijk (A50)-Dreumel												
622		Rossum Wilhelmina lock												
623		Nijmegen-Ewijk (A50)												
624		Ameide-Everdingen												
625		Streefkerk Ameide												
626		Kinderdijk Streefkerk												
627		Ravenswaai-Heteren												
628		Werkendam - Wilhelmina lock												
629		Kromme Nol- Hank (A27)												
630		Heerewaarden Meuse dyke												
631		Niftrik (A50)-Molenhoek												
632		Rossum-Well												
633		Alphen-Niftrik (A50)												
634		Polder Bern												
635		Alem												
636		Hank (A27)-Werkendam												

Key: * * * *

* In many cases, an integrated approach takes time, if only to be able to make the most of (co-)funding opportunities. That is why the Flood Protection Programme is drawing up a tentative schedule: a long-term schedule featuring flood risk management projects for the six years ahead (the official schedule), and the six years beyond. This gives stakeholders an early picture of imminent dyke improvements, enabling them at an early stage to initiate a discussion with the water-managing authorities regarding an integrated approach. The schedule is updated annually for another period of 12 years: a “fixed” 6-year schedule and a further tentative 6-year schedule. Once the tentative schedule projects have crystallised to a sufficient extent, they can be incorporated into the “fixed” schedule.

Knowledge development and innovation vitally important

(Technological) innovations and knowledge development among the managing bodies are important in order to attain the goals of the Flood Protection Programme. The programme is fostering this through Communities of Practice and the Knowledge and Innovation Process.

Dijkwerkers Community

Communities are intended to encourage collaboration and knowledge exchange between alliance partners. The Dijkwerkers [Dyke Workers] community is an umbrella organisation encompassing more than 40 communities with a total of over 850 members (dyke workers). Eight of these communities are Communities of Practice (CoPs), each focused on a specific group of dyke workers such as project managers, environmental managers, or concern controllers. The CoPs organise fifteen to twenty meetings annually to exchange knowledge. The communities are currently undergoing further professionalisation, among other ways by improved alignment with the Flood Protection Programme Goals. Overall control will remain vested with the Flood Protection Programme management. The focus will be on garnering a wider support base. In addition, concrete agreements are being set down regarding the (voluntary though fully committed) tasks incumbent upon COP participants. This boosts collaboration between the communities and with the Flood Protection Programme. This development was endorsed during the Flood Protection Programme Steering Group meeting of 20 March 2019, and is now being substantiated in concrete terms.

Knowledge and Innovation Process

In recent years, the Flood Protection Programme has fostered innovations in several ways, among which the General Explorations (GEs). This has borne fruit earlier than expected. By the end of 2018, innovations had already generated 160 million euros[17] of savings on dyke improvements scheduled under the Flood Protection Programme. Innovations are finding their way into actual practical implementation more rapidly. In the past (prior to 2010) such processes took at least fifteen to twenty years, whereas a recent innovation such as the dyke stabiliser has already seen its first application in a project after five years, the vertical sand-tight geotextile after four years, and the coarse sand barrier within three years. These initial successes are encouraging project organisations and dyke managers to apply and further develop new know-how generated by General Explorations. This is manifest in, for example, the Northern Randmeer dykes, Robust IJssel Dykes in the Krimpenerwaard, and Gorinchem-Waardenburg projects. For an innovation to pay it will need to be incorporated into regular working processes or be regarded as a fully-fledged alternative. In the years ahead, the Flood Protection Programme will focus additional attention on this issue by explicitly sharing any new expertise in scheduled projects, and during expertise and specialist meetings.

The General Explorations now featured in the Flood Protection Programme are nearing completion. The new insights help to gain a better picture of the tasking and to optimise the scheduling of projects. The Explorations produce diverse results. For example, the Eem Dyke Pilot has yielded substantial optimisations (30 per cent) in terms of the required strength and depth of sheet piling, whilst it has reduced the uncertainty regarding distortions. In the Eemshaven-Delfzijl dyke improvement projects, tests with cast in Norwegian Stone have resulted in savings of 25 million euros. Furthermore, long-term water level and wave measurements have shown this dyke to be in less urgent need of improvement. A method such as “current strength” has demonstrated several sections of dyke stretches to be stronger than was calculated earlier. Several innovations to prevent piping, macro instability, and micro instability have been field-tested in projects through General Explorations, and are now generally accepted technologies, such as the Dyke Monitoring and Conditioning System (DMC), vertical sand-tight geotextile, vacuum consolidation, the JLD dyke stabiliser, and dyke nailing. The development of another innovation to prevent piping, the Coarse Sand Barrier, is at an advanced stage. Such innovations will help to realise the Flood Protection Programme taskings quicker and cheaper.

Application of new knowledge and innovations will remain essential in order to achieve the programme goals set for 2050, in time and in an affordable manner. The flood probability approach opens up opportunities for carrying out dyke improvements more efficiently and cheaper, using new knowledge and technologies. Innovations are needed to reduce the impact of radical dyke improvements on local residents, and to protect cultural heritage along the dykes. In a few steps, the publication entitled Een Dijk van een Verhaal explains how to capitalise on the added value of cultural history in dyke improvements. The long lead time of the Flood Protection Programme affords ample room for devising innovations, exploring new technologies, and field-testing developments in projects.

The Flood Protection Programme is a learning programme. In 2019, a Flood Protection Programme Knowledge and Innovation Agenda will be introduced, on the basis of which new innovation projects will be launched. Innovation is thus substantiated not only through the General Explorations, but also in other ways. This is imperative in order to be able to complete the Flood

[17] Source: Dashboard vo.1 Monitoring of Innovations, 21 December 2018.

Protection Programme projects within the timeframe stipulated and under the available budget. In the years ahead, the programme office and especially the alliance will be focusing detailed attention on (1) univocal embedding and utilisation of developed knowledge within the Flood Protection Programme; (2) a targeted and efficient Knowledge and Innovation Process for the implementation of dyke improvement projects; and (3) the *form follows content* approach (focus on new knowledge requirements, which will generate the most appropriate way to develop such knowledge).

Second Flood Protection Programme

The Second Flood Protection Programme mainly comprises measures ensuing from the first and second assessments of the primary flood defence systems. The last projects under this programme are under way. The improvement of the Markermeer dykes commenced in early 2019. More information is provided in the 15th progress report on the Second Flood Protection Programme.

Room for the River and Zandmaas/Grensmaas

The "major project" status of the Zandmaas/Grensmaas and Room for the River projects was terminated on 22 January 2019. The goals set for these projects have been achieved. A minor tasking remains for the nature goal in the Grensmaas area. In April 2019, information on the achievement of the Grensmaas nature goal was forwarded to the House of Representatives. Considering that the natural environment will not attain its full development until years after completion of the Grensmaas project, an interim milestone was set down: by the end of 2018, 1208 hectares of soil needed to be available for nature development. At that time, 1125 hectares of soil were available, i.e., 83 hectares short of the interim milestone. Up until the completion of the project, the Grensmaas Consortium will be doing its utmost to secure as much soil as possible for nature development. In March 2019, the province of Limburg and the Ministry of Infrastructure and Water Management extended the Grensmaas Realisation Implementation Agreement by three years, which affords the Consortium another three years to extract gravel at the Koeweide/Trierveld location (Sittard-Geleen). Completion of the Grensmaas project will thus move up to no later than 31 December 2027.

WaalWeelde

In the WaalWeelde project, regional parties, the central government, the business community, and residents have joined forces, under the supervision of the province of Gelderland to render the river Waal safe, natural, and economically strong. In 2019, the "Restructuring of the Heesselt floodplains" and "Loenensche Buitenpolder" projects will be completed. This will mark the completion of all nine projects of the WaalWeelde implementation programme. For more information: see waalweelde.gelderland.nl.

IJsselmeer Closure Dam

The IJsselmeer Closure Dam (Afsluitdijk) project comprises dyke improvements and provisions for the expansion of the discharge capacity. For more information: see www.deafsluitdijk.nl.

Table 6: Schedule of General Explorations in progress

General Explorations and innovations under the Flood Protection Programme*		2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
No. on the map	**Name of General Exploration**												
322	Kerkhovenpolder-Germany pilot (Wadden Sea General Exploration												
322	Eemshaven-Delftzijl-MJVM												
	GE - dyke improvement using local soil												
	GE engineering structures												
	Flood Protection Programme Knowledge & Innovation Agenda												
	Reserve for Innovation												

Key: Study Exploration Plan elaboration Realisation

* These General Explorations do not pertain to any specific location; therefore, they are not reflected on the map.

Table 7: Second Protection Programme

Second Protection Programme		2020	2021	2022	2023	2024	2025	>
Budget: a total of 2,668 million euros, of which 422 million euros will be available with effect from 2020.								
	Den Oever flood defence							
	Houtrib dyke							
503	Markermeer dyke Hoorn-Edam-Amsterdam							
504	Texel Wadden Sea dyke							

Key: Exploration Plan elaboration Realisation

Table 8: Meuse projects measures

Meuse projects		2020	2021	2022	2023	2024	2025	>
Grensmaas budget: a total of 116 million euros, of which 31 million euros will be available with effect from 2020								
Zandmaas budget: a total of 400 million euros, of which 58 million euros will still be available with effect from 2020.								
806	Grensmaas project, 11 locations							
807	Final element embankments, Limburg district water board							
808	Final element embankments, Limburg district water board							

Key: Exploration Plan elaboration Realisation

Table 9: IJsselmeer Closure Dam measures

IJsselmeer Closure Dam measures		2020	2021	2022	2023	2024	2025	>
Budget: a total of 1,613 million euros, of which 1,565 million euros remaining with effect from 2020.								
421	IJsselmeer Closure Dam							

Key: Exploration Plan elaboration Realisation

Repair of Oosterschelde and Westerschelde stone claddings, and foreshore deposits in Zeeland

The Repair of Zeeland Stone Claddings programme was successfully completed in 2016. The programme involved an expenditure of some 750 million euros. The Foreshore Deposits programme, involving stone deposits at 27 locations, is still in progress. These deposits are intended to reinforce the foreshores and thus combat flow slide. In 2018, Rijkswaterstaat embarked on the preparations for deposits at 17 locations (cost: 62.8 million euros). These deposits will be completed by 2023. In January 2019, the Ministry of Infrastructure and Water Management concluded a covenant with the Scheldestromen district water board and the province of Zeeland. The parties have agreed that the district water board will tackle the other 10 locations in the period up to 2026 (cost: 10.6 million euros). The deposits at the Rijkswaterstaat locations will commence at the end of 2019. They involve projects 912, 913, and 915 up to and including 927 on the Delta Plan on Flood Risk Management map (see Map 1). The 11 locations to be tackled by the district water board have entered the preparatory stage.

River widening: IJssel Delta phase 2, Pannerdensch Canal groyne lowering, Ooijen-Wanssum area development

Along the rivers Rhine and Meuse, three projects are being implemented to lower the river water level (Table 10). The IJssel Delta phase 2 and Ooijen-Wanssum projects also encompass dyke improvements. More information is provided on the www.mirtoverzicht.nl website.

Table 10: Realisation of river widening measures

Realisation	2020	2021	2022	2023	2024	2025	>
Rhine							
732 IJssel delta phase 2							
733 Pannerdensch Canal groyne lowering							
Meuse							
731 Ooijen-Wanssum area development							

Key: Exploration Plan elaboration Realisation

3.2.2 River widening in interconnection with dyke improvement

In order to see river widening off to a meaningful start the central government has set aside Delta Fund resources as its share in the additional cost of river widening measures (200 million euros). Based on regional proposals for the Rhine and Meuse, the Minister of Infrastructure and Water Management has agreed to the MIRT Studies and MIRT Explorations listed in Table 11.

Meuse

The river Meuse is the subject of several MIRT Studies and MIRT Explorations. At the MIRT Consultation Committee meeting of November 2018, the central and regional governments took several decisions in this respect:

1) 1) The exploration regarding the Oeffelt bottleneck will conditionally move on to the plan elaboration phase;
2) The Lob van Gennep and Alem River Widening studies (ensuing from the Maasoeverpark MIRT Study) will conditionally move on to the exploration phase. Meanwhile, Lob van Gennep meets the conditions set by the MIRT Consultation Committee[18]; the exploration commenced in early 2019.
3) In the "Veerweg Alphen bridge extension" project, which is to be implemented under the ongoing "On the Meuse" project, the central and regional governments will jointly contribute to measures aimed at realising additional water level reduction. The exact contributions will be set down following administrative consultations with the partners in 2019.

The MIRT Study into the southern Meuse valley (formerly Maastricht), finally, is still in progress[19].

With respect to the river Meuse, five system restoration measures are being explored (Table 2). The explorations, to be conducted under the Flood Protection Programme, pertain to dyke improvements (Administrative Agreement on the Meuse, 2011) in combination with dyke relocations. The preferential alternatives for four system measures will be set down in 2019. The Venlo-Velden system measure was included in the "More Meuse More Venlo" MIRT Exploration. This exploration was officially terminated in early 2019; several regional partners resigned from the project. The dyke improvement will continue to be conducted under the Northern Meuse Valley Flood Protection Programme. With respect to the dyke tasking and the Venlo-Velden dyke relocation system restoration measure, the Limburg district water board and the central government will need to set down new agreements to set up a Flood Protection Programme / MIRT Exploration.

Rhine

In June 2018, the Minister of Infrastructure and Water Management endorsed the preferential decision regarding Varik-Heesselt: dyke improvement with nature and water compensation in the flood plains. This is the most effective measure for the area to meet the new standards. The Minister also decided to continue the land reservations for the flood channel[20]. In 2015, a pilot study was conducted in the Rijnstrangen area to explore ways to prevent or reduce an adverse effect of prolonged spatial reservations in the purview of flood risk management. A similar study regarding the Varik-Heesselt area was launched at the end of 2018, in collaboration with the regional partners, aimed at rendering the area safe, functional, and attractive. The House of Representatives was informed of the outcomes of this study on 13 June 2019[21]. The area can continue to develop under the existing policy.

[18] Parliamentary Document 32 698, no. 45 (in Dutch).

[19] The Southern Meuse valley is no. 701 on Map 1, Delta Plan on Flood Risk Management.

[20] Parliamentary Document 27 625 no 434 (in Dutch).

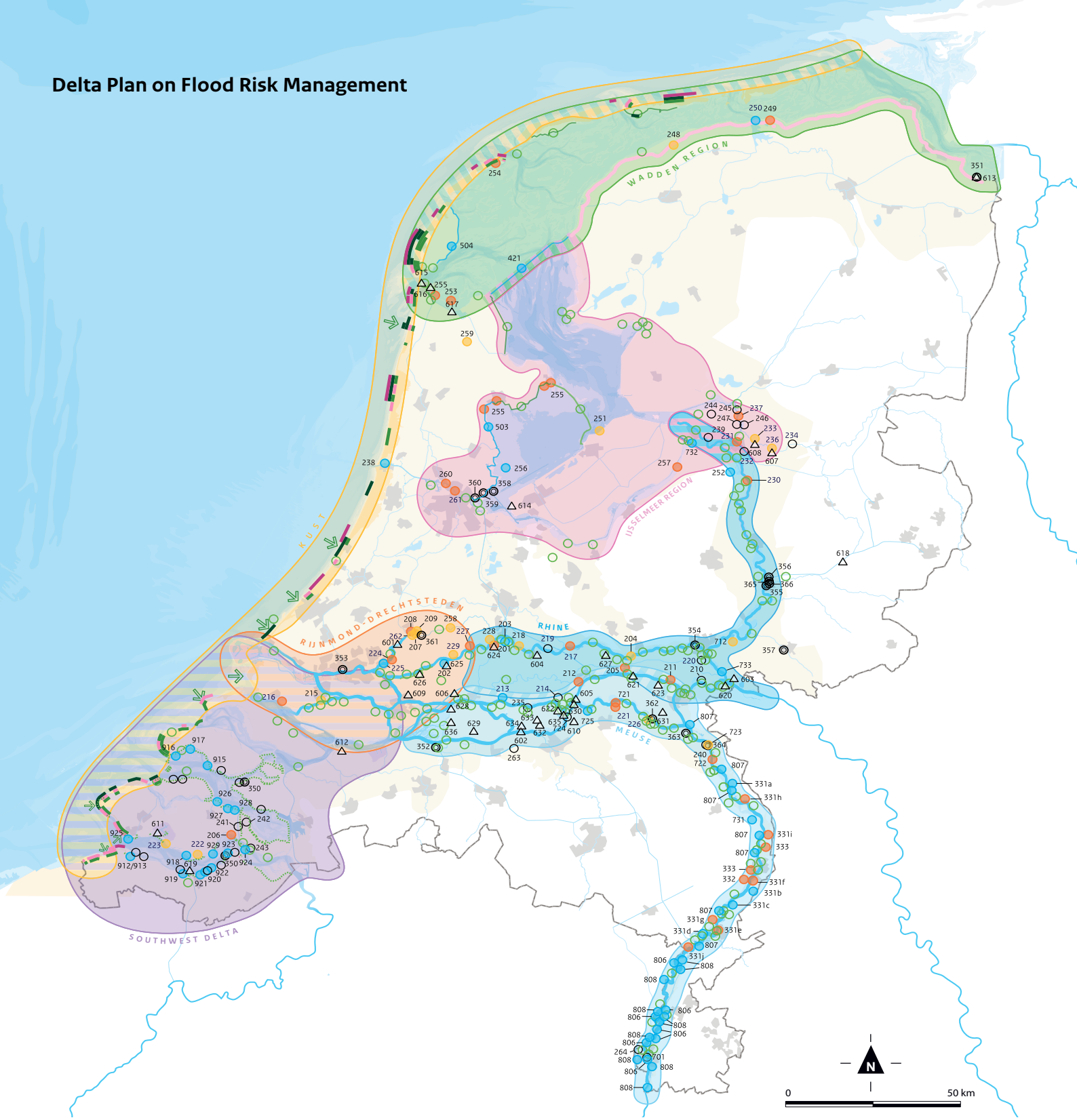
[21] Parliamentary document 27 625, no. 472 (in Dutch)

Table 11: MIRT Explorations into river widening

MIRT Explorations		2020	2021	2022	2023	2024	2025	>
Rhine								
712	IJsselpoort river climate adaptation park 1st phase							2028
Meuse								
721	Meandering Meuse (formerly Ravenstein-Lith)							
722	Oeffelt bottleneck							
723	Lob van Gennep							2026
724	Alem River widening							
725	Extension of Veerweg bridge, Alphen							

Key: Exploration Plan elaboration Realisation

Delta Plan on Flood Risk Management



Projects and implementation programmes Project numbering refers to measures scheduled in the Delta Programme. Colour, if any, indicates plan phase.

Flood Protection Programme (HWBP) 2019-2024

- 200/300 Project number
- Dyke improvement project
- General exploration Wadden Sea dykes (322)
- Meuse agreement project
- Pre-financed dyke improvement project

Second Flood Programme (HWBP-2)

- 500 Project number
- Improvement to dyke, dune, dam or engineering structure
- Dyke section
- Weak Links on the Coast projects

Flood Protection Programme tentative schedule HWBP 2025-2030

- 600 Project number
- Project location

(MIRT) River widening projects

- 700 Project number
- Project location

Meuse projects: Grensmaas and Zandmaas

- 800 Project number
- Project location

Overige projecten

- 400 Project number
- Project location

Repairs of stone cladding in Oosterschelde and Westerschelde, Zeeland shore face deposits

- 900 Project number
- Stone cladding
- Deposit location

Sand replenishment locations 2012-2023

- Beach replenishment scheduled
- Beach replenishment completed
- Shore face replenishment scheduled
- Shore face replenishment completeded

Status per project: Plan phase as of 2020

- Scheduled
- Study
- Exploration
- Plan elaboration
- Realisation
- Completed

* Status does not apply for Flood Protection Programme tentative schedule 2025-2030

Basic map

- Freshwater
- Saltwater / brackish water
- Flood-prone area
- Area outside the dykes
- Urban area
- Docks
- Border

Map 1 *Delta Plan on Flood Risk Management.*

CHAPTER 4

Freshwater supply: progress and measures

Innovative saline production, Wieringermeer sponge crab farm

This Chapter addresses the implementation of the Delta Decision on Freshwater Supply (Paragraph 4.1) and the progress in the measures set out in the Delta Plan on Freshwater Supply (Paragraph 4.2).

4.1 Delta Decision on Freshwater Supply

The Delta Decision on Freshwater Supply is intended to secure a sufficient supply of fresh water in the Netherlands, now and in the future, including in drier periods. On the one hand, this calls for economy in the consumption of water and on the other, efficient utilisation and distribution of the available water.

4.1.1 Progress

The Delta Decision on Freshwater Supply is being implemented along three tracks: the Delta Plan on Freshwater Supply, the Water Availability process, and the Knowledge Track. Several key elements are explained below. The annual progress report[22] provides a detailed overview of the progress made.

Assessment of the 2018 drought

The year 2018 saw an exceptionally dry spring, summer and autumn. This prolonged period of drought has once more underscored the urgency of the Delta Plan on Freshwater Supply. At several locations, the drought has caused problems. Farmlands and nature reserves suffered damage due to salinisation and a shortage of fresh water. Urban and rural areas were affected by water quality issues, whilst low groundwater levels caused additional soil subsidence and foundation damage. A substandard surface water quality jeopardised the intake of IJsselmeer water for drinking water purposes near the town of Andijk in the province of Noord-Holland. Low navigable depths and restrictions near locks hampered the shipping sector, leading to bottlenecks in the supply of raw materials.

At the same time, the measures set out in the Delta Plan on Freshwater Supply proved their worth during this dry period. The Netherlands turned out to be properly prepared for (imminent) water shortages: the new IJsselmeer water level ordinance and the Climate-proof Water Supply system in the central part of the Netherlands proved effective. Smart Water Management has also proven its worth on the ground; this method turned out to be of great value to the National Water Distribution Coordination Committee, Rijkswaterstaat, and the district water boards in the consideration of drought measures and water distribution. In some cases, however, setting down priorities was quite troublesome and not all damage could be prevented. This was particularly manifest at the Elevated Sandy Soils, which area was already affected by drought at an earlier stage and where many locations were cut off from the water supply. This caused water courses to run dry as well as extremely low groundwater levels.

At the end of 2018, the Minister of Infrastructure and Water Management set up the temporary Drought Policy Platform. Its aim is to translate the lessons learned from the drought into policy proposals, in order to be better prepared for the drought seasons of 2019 and beyond. The participants to the Drought Policy Platform are representatives of the governments (central government, Association of Provincial Authorities, Association of Dutch Regional Water Authorities, Association of Netherlands Municipalities), and drinking water companies (Vewin). The Freshwater Administrative Platform and the Delta Programme Commissioner's staff are also represented in order to safeguard a proper liaison with the Delta Plan on Freshwater Supply. The water consumers are involved through the Physical Environment Consultative Body.

Even before the new drought season set in on 1 April 2019, the Drought Policy Platform presented its first report detailing the most urgent issues. The Minister of Infrastructure and Water Management has forwarded the report along with a response to the House of Representatives. By the end of 2019, the final report will be available to the decision-making bodies and the House of Representatives. Four issues call for action on the part of the Freshwater Administrative Platform and the IJsselmeer Region Administrative Platform:

- Prioritisation scheme: the Water Crises and Flooding Management Steering Group has drawn up explanatory guidelines to the prioritisation scheme (Article 2.1 of the Water Decree). The guidelines, which have been completed by now, provide background information regarding the prioritisation scheme which may be helpful to water managing bodies implementing the prioritisation scheme in times of (imminent) water shortages.
- Areas in which groundwater supplies were under pressure in 2018: the managing bodies are aiming for short-term

[22] See Background Document B (in Dutch).

restoration through water and level management. With respect to long-term measures, the regional consultative bodies will focus additional attention on the transition towards increased water retention in the sandy soils. This transition has already set in under the Delta Plan on Freshwater Supply, but the 2018 drought has sharply emphasised its urgency.

- National water distribution and salinisation: the relevant freshwater supply regions and Rijkswaterstaat are working on coordinated administrative agreements, based on the lines of reasoning elaborated within the context of Smart Water Management. An important element is the exchange of information and monitoring data, for example, via information screens. The administrative agreements pertain to the operational management to be pursued in 2019 and to supra-regional considerations foreseen for 2020.
- IJsselmeer Region: the IJsselmeer Region Administrative Platform is setting down administrative agreements on water distribution, which it will elaborate, by April 2020, into lines of reasoning regarding water distribution and water quality. Furthermore, a study is being conducted into the resilience of the IJsselmeer Region in periods of drought, on the basis of a joint fact-finding process.

Last year's drought has also given impetus to the collaboration with parties working on a climate-adaptive substantiation of the agriculture and nature taskings. Climate Adaptation Action Programmes for both sectors are being developed[23].

Developments in the Delta Plan on Freshwater Supply

The implementation of the measures set out in the Delta Plan on Freshwater Supply is proceeding largely according to schedule. All the freshwater supply regions and the central government (Rijkswaterstaat and the Ministry of Infrastructure and Water Management) are working on the measures agreed upon. The drinking water sector is also making investments to secure the future drinking water supply.

One of the milestones achieved in 2018 involved the demarcation of the area covered by the new IJsselmeer water level ordinance. This will enable Rijkswaterstaat and the district water boards in the area around Lake IJsselmeer to respond more efficiently during extremely dry periods and to gear supplies more efficiently to the freshwater requirements. Several other measures were also completed in 2018, for example, the adaptation of the water inlet in the Prinses Irene locks, climate adaptation pilots such as Spaarwater 2 to retain water, and several brook restoration projects.

Some other measures were delayed or entail longer lead times. Such measures include the capacity expansion of the Central Netherlands Climate-proof Water Supply (KWA) and the freshwater supply measures related to the plan to salinise the Volkerak-Zoommeer lake. In 2018, word came out that the decision regarding a saline Volkerak-Zoommeer lake is still pending. However, the development perspective for the lake (saline and limited tidal movement) is not under debate. The regional authorities are going to determine which components will be implemented in the years ahead, in interconnection with the review of the freshwater supply strategy. For that reason, the Southwest Delta region has drawn up an alternative set of measures, which was endorsed by the Freshwater Administrative Platform on 14 March 2019. These measures will be implemented in the period 2019-2021.

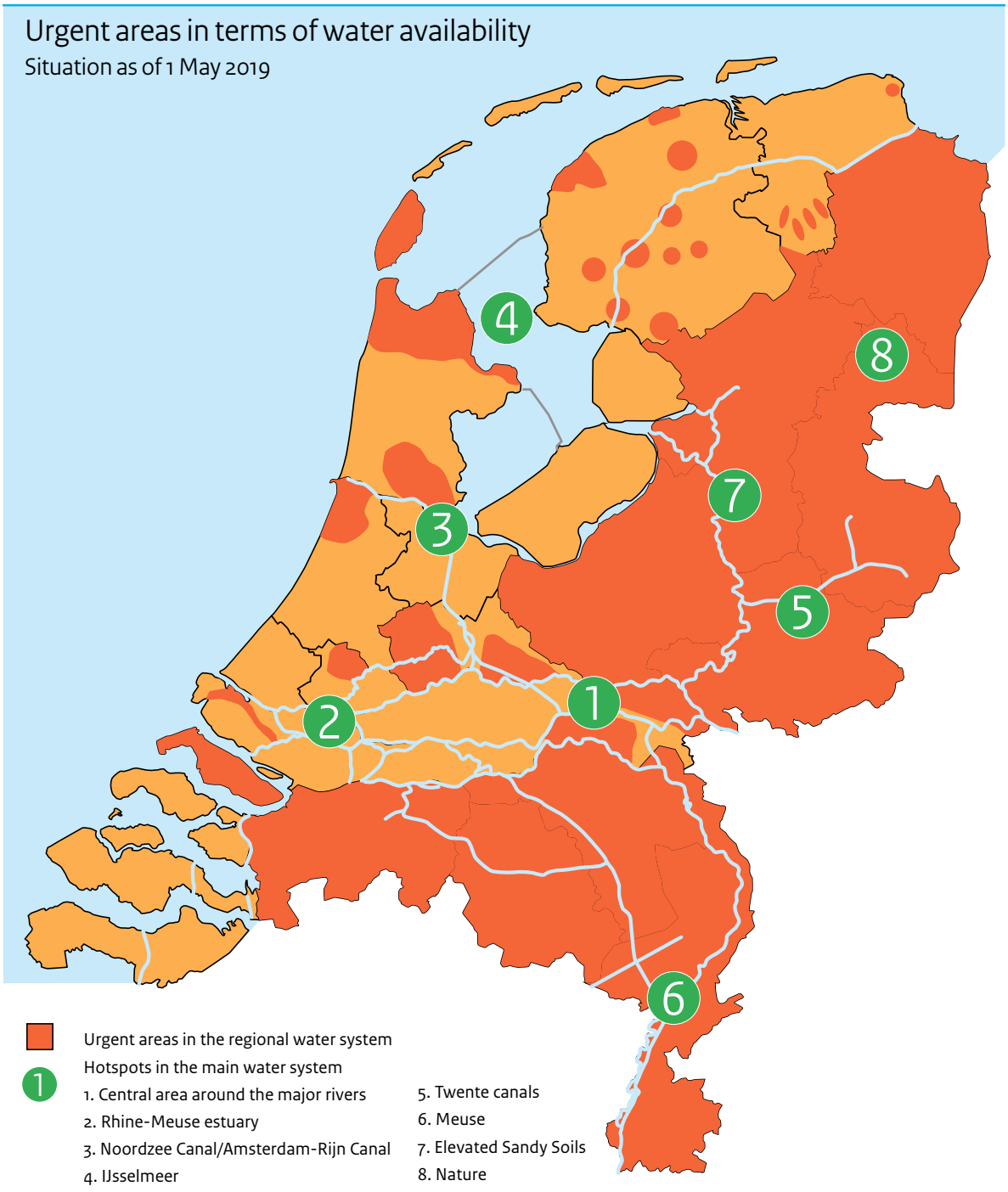
Phase 2 of the Delta Plan on Freshwater Supply - measures pertaining to the period 2022-2027 – is currently in preparation (see Paragraph 4.2).

Water availability

The Water Availability instrument indicates the availability of fresh water and the probability of water shortages in an area, under both normal and dry conditions. Such insights constitute the basis for transparent decisions regarding the distribution of water and the measures implemented under the Delta Plan on Freshwater Supply. The insights also provide the consumers with clarity regarding their own responsibilities, thus enabling them to anticipate changes in the availability of fresh water.

The interim evaluation of the Water Availability process in 2018 generated four points for attention: the Delta Plan on Spatial Adaptation, the actual scheduling of measures for urgent areas, and the manner in which the optimisation and efficiency of current water management are discussed and set down. All these points for attention have been addressed. In the spring of 2018, the Freshwater Administrative Platform agreed to give priority to the elaboration of water availability issues in urgent areas, and wherever possible, to link up with the stress tests being conducted under the Delta Plan on Spatial Adaptation. Meanwhile, the Freshwater Administrative Platform has set down the map with urgent areas identified by the freshwater supply regions (see Map 2). The elaboration of the water availability issues in these areas must be completed by no later than 2021. In the Elevated Sandy Soils area, water availability is largely embedded into integrated regional processes, whilst the planning is also affected by other taskings; consequently, 2021 is not always a feasible deadline.

[23] See Memorandum by the Minister of Agriculture, Nature and Food Quality, Parliamentary Document 35000-XIV no. 63 (session year 2018-2019).



Map 2 *Urgent areas in terms of water availability.*

The 2018 drought underscores the importance of water availability. The drought experience has fostered a sense of urgency among both consumers and water managers. Furthermore, the drought has also made inroads into staff deployment, in some cases at the expense of staff deployed in the regional processes. The agreement to have regional water availability processes in place in the urgent areas by 2021 will not be endangered. With respect to the Elevated Sandy Soils region, the agreement is to complete the first step (transparency regarding the availability of water availability and existing agreements) in all the urgent areas by 2021. Optimisations and new agreements will tie in with regional processes that are underway or will be launched, either before or after 2021.

The Freshwater Administrative Platform discusses the progress made during the annual review meetings. In the purview of aligning the water availability process and the spatial adaptation stress tests, maps have been developed visualising an area's vulnerability to drought in terms of the two instruments.

Knowledge and innovation

The Freshwater Supply knowledge track is generating new expertise regarding the water system, more efficient model instruments, insight into the effectiveness of (hydrological and economic) measures, and information to underpin the review of the freshwater supply strategy. The process comprises a range of studies and analyses. Several studies were completed in 2018.

For example, a hotspot analysis[24] was conducted to map out supra-regional bottlenecks and supplementary measures, using the hundred-year series derived in 2017 within the context of the National Water Model. An updated bottleneck analysis has also been completed; this analysis addressed potential future trends in water demands and water shortages ensuing from climate changes and socio-economic developments, in response to the updating of the Delta Scenarios in 2017[25]. This bottleneck analysis serves as the collective information basis for the exploration of measures scheduled in phase 2 of the Delta Plan on Freshwater Supply.

The European research project entitled Improving Predictions and Management of Hydrological Extremes (IMPREX) has made progress with its risk-based approach to the analysis of drought and water shortages in the Netherlands. This will provide a better basis for water availability decisions and measures. In the salinisation knowledge alliance, a field-test has been launched into the salt tolerance of flower bulbs.

4.1.2 Potential amendment of the Delta Decision

DP2021 will comprise proposals for the review of the Delta Decisions and the regional Preferential Strategies. DP2020 before you maps out the potential amendments, by way of a first step. Chapter 2 outlines the process. The bottleneck analysis 2.0 constitutes an important basis for the review relating to the freshwater supply. The experience gained during the 2018 drought will be taken into consideration as well. The main recommendations are set out in Paragraph 4.1.1 (Assessment of the 2018 drought). For each freshwater supply region, Chapter 7 details the potential amendments and optimisations of the Preferential Strategies for the freshwater supply.

In 2018, the Freshwater Administrative Platform decided that the elaboration of the Water Availability process in urgent areas must be completed by no later than 2021 (see Map 2, Urgent Areas in terms of Water Availability). The implementation of the Delta Decision on Freshwater Supply is on course.

In May 2019, the Freshwater Administrative Platform agreed on the formulation of freshwater supply targets for 2050 – similar to those formulated for flood risk management and spatial adaptation – wherever possible utilising the national goals as set down in DP2015. Following the first six-year review, the goals for 2050 will be incorporated into the Delta Decision on Freshwater Supply as set out in DP 2021.

Under the auspices of Rijkswaterstaat, a first line of thought has been developed for the creation and retention of freshwater supply buffers in the main water system. A restructuring of the main water system will generate considerable savings in terms of the volume of water required to stem the saltwater wedge in the Nieuwe Waterweg. This so-called controllable buffer network constitutes a first potential strategy; it will be elaborated further and discussed in the Freshwater Administrative Platform, on the road towards the second six-year review in DP2027. One of the criteria for the selection of measures to be implemented in phase 2 of the Delta Plan on Freshwater Supply is the extent to which the measures fit within a controllable buffer network.

[24] See: www.deltacommissaris.nl/deltaprogramma/documenten/publicaties/2019/03/22/hotspotanalyses-voor-het-deltaprogramma-zoetwater (in Dutch).

[25] See: www.deltacommissaris.nl/deltaprogramma/documenten/publicaties/2019/05/09/geactualiseerde-knelpunten-voor-het-deltaprogramma-zoetwater-fase-ii (in Dutch).

4.2 Delta Plan on Freshwater Supply: measures to secure the availability of fresh water in the Netherlands

The Delta Plan on Freshwater Supply comprises all the measures, studies, and knowledge issues relating to a sustainable freshwater supply that have been scheduled and agendised, and that are funded – in whole or in part – from the Delta Fund.

Phase 1 measures

The regions, the central government, and consumers are going full steam ahead with the implementation of the measures set out in Phase 1 of the Delta Plan on Freshwater Supply (2015-2021). In the period up to 2021, the overall expenditure scheduled for the freshwater supply measures contained in the Delta Plan total more than 400 million euros, of which a sum of 159 million euros will be funded from the Delta Fund. Nearly all the measures will have been completed by 2021. On 14 March 2019, the Freshwater Administrative Platform endorsed the extension of several measures until 2023. In addition, the Platform has decided that the budget scope of 7 million euros up to and including 2021 (balance of risk reserves becoming available, windfalls, and setbacks) will be spent on, inter alia, specific measures generated by the Drought Policy Platform, urgent projects in the Elevated Sandy Soils East and South areas (which experienced major problems during the 2018 drought), and improvement of the knowledge base (see Table 14). These measures will be co-funded by regional parties.

Table 12 presents an overview of scheduled and agendised studies and measures to substantiate the Delta Decision and the Preferential Strategies for the freshwater supply. These studies and measures ensue from the Freshwater Supply Investment Programme 2015-2021, as contained in Delta Programme 2015. The investment programme has been compiled on the basis of a national investment agenda, the regional implementation programmes of the freshwater supply regions, and a number of implementation programmes of the user functions.

The central government and the regions have set down financial arrangements regarding the Freshwater Supply Investment Programme in the Administrative Agreements on Freshwater Supply[26]. Table 13 specifies the Delta Fund – regional funding ratio for each measure.

Smart Water Management

The Smart Water Management measure contained in the Delta Plan on Freshwater Supply focuses on efficient operational water management across the management boundaries of several water managing bodies. Smart Water Management involves the real-time exchange of data among water managing bodies, using new technologies and collective information screens. Thus, the water managing bodies gain direct insight into each other's problems. They employ the same line of reasoning, which they practise by playing a serious game. A line of reasoning indicates the smartest possible distribution of water in an area, based on an integral survey of the current and expected situations.

The measure is currently being fleshed out in six Smart Water Management regions, spread across the Netherlands. In these regions, the water managing bodies concerned collectively elaborate measures to optimise operational water management and energy consumption. Supra-regional issues are addressed collectively. In 2018, the upgraded www.slimwatermanagement.nl digital platform was completed. Through this platform, the parties exchange knowledge and information. In 2018, the regions continued their work on collective information screens that provide real-time insight into the water distribution, and introduced consistency in the regional lines of reasoning with respect to water distribution. The drought of 2018 and the westerly gale of 18 January 2018 have demonstrated the added value of Smart Water Management in actual practice. In these types of extreme situations, collaboration and easily accessible information are essential.

Phase 2 measures

In 2022, the Delta Plan on Freshwater Supply will be entering Phase 2, comprising measures for the period 2022 - 2027. The Road Map[27] reflects the process up to the decisions made on the set of measures. The set of measures will be compiled on the basis of insight into the impact of the measures that have already been implemented or are currently underway, the results of the (regional) dialogues regarding the Water Availability instrument, and knowledge derived from analyses, calculations, and studies.

With respect to the main water system, two instruments provide insight into the demand for and supply of fresh water: the Water Availability [Wabes] model and the Bottleneck Analysis. The results of the Water Availability model were already available online by early 2018, featuring information regarding the probability and duration of water shortages at some 150 locations in the main water

[26] See DP2015, Paragraph 2.5.

[27] See DP2019, Paragraph 4.2.

system. The model was updated in March 2019 to include, inter alia, expectations with respect to the four Delta Scenarios by 2050 and the "Paris" variant. At the end of 2018, the outcomes of the Bottleneck Analysis 2.0 were also presented and discussed. In the period ahead, the focus will shift towards promising measures and optimisations. To this end, a list of potential measures was already drawn up in 2018. These measures constitute the basis for the elaboration of the set of measures to be implemented in Phase 2 of the Delta Plan on Freshwater Supply (2022 up to and including 2027).

Insight into the availability of water is a prerequisite for the selection of appropriate measures. All the freshwater supply regions are working on such insights by conducting pilots, analyses, and regional processes. The dry summer of 2018 has placed the issue of water availability emphatically on the agendas of the regional processes. The progress made by the regions is outlined below:

- The West Netherlands freshwater supply region has launched some twenty regional processes in which water availability is the focus or features in another regional tasking. Some of the processes have already been completed. The dialogue addresses options to climate-proof the water supply, factoring in the effectiveness of measures.
- In the IJsselmeer Region, the Hollands Noorderkwartier district water control board has conducted a study into the optimisation of water distribution in the storage basin system, on the basis of which it has drawn up a water distribution strategy. The Oostpolder regional process has generated agreements between water managing bodies and farmers regarding optimisations in the water system, and insight into the options offered by freshwater supply measures to be taken by farmers themselves. During the dry summer of 2018, the Hunze en Aa's district water board experimented with pumping water to the peat districts in the province of Groningen, which were faced with water shortages. The water originated from Oldambt, in which water saving had safeguarded a sufficient supply. The district water board is exploring the feasibility of expanding the water supply for the Groningen peat districts.
- The Elevated Sandy Soils (East and South) region has drawn up a plan of approach for the further elaboration of the Water Availability process, within the context of the freshwater supply strategy for this region. The plan of approach is intended to result in an action perspective for the water managing bodies and consumers in times of drought, now and in the future. The planned activities will provide more insight into the availability of water and enhance commitment among consumers. With respect to the Elevated Sandy Soils, structural measures are required to retain water, and to improve the region's resilience to the increasing probability of extreme drought and extreme waterlogging.
- In Zeeland, the Southwest Delta region has organised regional meetings on the Water Availability process. Thus, the phase of creating transparency regarding the freshwater supply bottlenecks has nearly been completed. The Zuid-Holland municipalities in the Southwest Delta have incorporated the Water Availability process in the climate change stress tests conducted in 2018. They have thus updated the results of the regional Water Availability process conducted in 2013.
- The areas around the major rivers have conducted several pilots in the purview of the Water Availability process. The outcomes and experience of the Kop van de Betuwe freshwater supply pilot and the Land van Maas en Waal spatial adaptation pilot are being used for dialogues regarding the Water Availability process in the Overbetuwe and Land van Maas en Waal areas. In the climate adaptation pilot involving the sustainable use of shallow groundwater, the governments are collaboration with stakeholders in the region.

Table 12: Schedule of measures set out in the Delta Plan on Freshwater Supply

Delta Plan on Freshwater Supply 2020-2023		2020	2021	2022	2023
IJsselmeer Region					
171	*Flexibilisation of IJsselmeer lake water level, involving:*				
171a	MWS: new IJsselmeer water level ordinance (2017)				
171b	MWS: operationalisation of flexible water level management				
171c	MWS: measures pertaining to Frisian IJsselmeer lake shores				
171d	MWS: robust and natural shores in IJsselmeer Region, phase 1				
171e	MWS: Implementation of IJsselmeer water level ordinance				
172	*Northern region elevated grounds project programme, involving:*				

Key: Study Exploration Plan elaboration Realisation Completed Climate adaptation pilots Policy development

Delta Plan on Freshwater Supply 2020-2023		2020	2021	2022	2023
172a	Natural design of Dwarsdiep area				
172b	Climate-proofing Drentse Aa basin				
172c	Optimisation of farmland intakes, Northern Netherlands elevated (sandy) soils				
172d	De Dulf-Mersken and vicinity area development				
173	*IJsselmeer Region testing ground, involving:*				
173a	Spaarwater				
173b	Gouden gronden				
173c	Hunze en Aa's testing ground				
173d	Wetterskip Fryslân testing ground				
Elevated Sandy Soils					
174	Implementation programme for Elevated Sandy Soils Delta Plan, Southern Region				
175	Implementation programme for Elevated Sandy Soils freshwater supply, Eastern Region				
176	Innovative climate adaptation pilot South: sub-irrigation				
177	Innovative climate adaptation pilot East 1: effluent sub-infiltration				
178	Innovative climate adaptation pilot East 2: smart weir				
179	Innovative climate adaptation pilot East 3: Zutphen water distribution				
West Netherlands					
180	MWS: Irene locks (KWA+ in MWS)				
181	Climate-proof Water Supply West Netherlands (KWA)				
182	Optimisation of Brielse Meer lake water supply, step 1				
183	Innovative climate adaptation pilot De Groote Lucht freshwater plant				
Southwest Delta					
184a	Roode Vaart transfer to West-Brabant and Zeeland				
184b	Resilient regional water system measures				
185	*Climate adaptation pilot Zeeland freshwater supply testing ground, involving:*				
185a	E1 - FRESHEM freshwater-saltwater mapping				
185b	E2 - GO-FRESH II subsoil water preservation				
185c	E4 - Wetland - Mild Desalinisation Environmental approach & pilot study				
185d	E5 - DeltaDrip				
185e	E6 – Salt management in the pursuit of salt-tolerant potato				
185f	E7 - More fruit with less water				
185g	E10 – Area Freshmaker exploration				
185h	E11 - Waterhouderij Walcheren Exploration				
185i	E12 - Drainstore				
185j	Additional resources for the Freshwater Supply testing ground				
Area around the major rivers					
186	MWS: study into longitudinal erosion control dams				
187	Launch of measures in area south of the major rivers				
188	Innovative climate adaptation pilot regarding sustainable use of shallow groundwater				
Main water system					
189	Water availability in the Main Water System (MWS)				
190	Smart Water Management (SWM)				
191	Noordervaart				

Key: Study Exploration Plan elaboration Realisation Completed Climate adaptation pilots Policy development

Table 13: Freshwater supply investment programme 2019-2023 (in thousands of euros)

Delta Plan on Freshwater Supply 2019-2021		Delta Fund 2019-2021	Delta Fund 2022-2023	Regional contributions* 2019-2023	Total 2019-2023	Total contribution from Delta Fund 2015-2023**
IJsselmeer Region						
171	*Flexibilisation of IJsselmeer lake water level, involving:*					
171a	MWS: new IJsselmeer lake water level ordinance	€ 0	€ 0	€ 0	€ 0	**€ 1,300**
171b	MWS: operationalisation of flexible water level management	€ 390	€ 0	€ 0	€ 390	**€ 930**
171c	MWS: measures pertaining to Frisian IJsselmeer lake shores	€ 6,338	€ 5,662	€ 4,887	€ 16,887	**€ 12,000**
171d	MWS: robust and natural shores in IJsselmeer Region, phase 1	€ 2,200	€ 0	€ 0	€ 2,200	**€ 2,260**
171e	MWS: Implementation of IJsselmeer water level ordinance	€ 3,400	€ 0	€ 0	€ 3,400	**€ 3,400**
172	*Northern region elevated grounds project programme, involving:*					
172a	Natural design of Dwardsdiep area	€ 380	€ 131	€ 1,244	€ 1,755	**€ 570**
172b	Climate-proofing Drentse Aa basin	€ 163	€ 0	€ 3,287	€ 3,450	**€ 200**
172c	Optimisation of farmland intakes, Northern Netherlands elevated (sandy) soils	€ 3	€ 0	€ 26	€ 29	**€ 15**
172d	De Dulf-Mersken and vicinity area development (Nijbeets)	€ 71	€ 0	€ 0	€ 71	**€ 212**
173	*IJsselmeer Region testing ground, involving:*					
173a	Spaarwater	€ 0	€ 0	€ 0	€ 0	**€ 700**
173b	Gouden gronden	€ 48	€ 0	€ 930	€ 978	**€ 91**
173c	Hunze en Aa's testing ground	€ 139	€ 0	€ 0	€ 139	**€ 200**
173d	Wetterskip Fryslân testing ground	€ 110	€ 0	€ 117	€ 227	**€ 210**
Elevated Sandy Soils						
174	Implementation programme for Elevated Sandy Soils Delta Plan, Southern Region	€ 19,740	€ 0	€ 63,780	€ 83,520	**€32,900**
175	Implementation programme for Elevated Sandy Soils freshwater supply, Eastern Region	€ 16,200	€ 0	€ 53,980	€ 70,180	**€ 27,100**
176	Climate adaptation pilot South: sub-irrigation	€ 0	€ 0	€ 133	€ 133	**€ 50**
177	Climate adaptation pilot East 1: effluent sub-infiltration	€ 0	€ 0	€ 0	€ 0	**€ 23**
178	Climate adaptation pilot East 2: smart weir	€ 0	€ 0	€ 0	€ 0	**€ 11**
179	Climate adaptation pilot East 3: water distribution	€ 0	€ 0	€ 0	€ 0	**€ 18**
West-Netherlands						
180	MWS: Irene locks (KWA+ in MWS)	€ 0	€ 0	€ 0	€ 0	**€ 300**
181	Climate-resilient Water Supply West-Netherlands (KWA) (KWA)	€ 13,700	€ 20,100	€ 0	€ 33,800	**€ 37,300**

Delta Plan on Freshwater Supply 2019-2021		Delta Fund 2019-2021	Delta Fund 2022-2023	Regional contributions* 2019-2023	Total 2019-2023	Total contribution from Delta Fund 2015-2023**
182	Optimisation of Brielse Meer lake water supply, step 1	€ 2,700	€ 0	€ 1,700	€ 4,400	**€ 2,700**
183	Climate adaptation pilot De Groote Lucht freshwater plant	€ 0	€ 0	€ 0	€ 0	**€ 500**
	Other measures involving the regional water system	€ 0	€ 0	€ 11,000	€ 11,000	**€ 0**
Southwest Delta						
184a	Roode Vaart transfer to West-Brabant and Zeeland	€ 8,950	€ 0	€ 10,997	€ 19,947	**€ 9,025**
184b	Resilient regional water system measures	€ 1,405	€ 0	€ 1,405	€ 2,810	**€ 1,405**
185	*Climate adaptation pilot Zeeland freshwater supply testing ground, involving:*					
185a	E1 - FRESHEM Freshwater-saltwater mapping	€ 0	€ 0	€ 0	€ 0	**€ 738**
185b	E2 - GO-FRESH II subsoil water preservation	€ 0	€ 0	€ 0	€ 0	**€ 230**
185c	E4 - Wetland - Mild Desalinisation Environmental approach & pilot study	€ 867	€ 0	€ 867	€ 1,734	**€ 928**
185d	E5 – DeltaDrip	€ 75	€ 0	€ 325	€ 400	**€ 100**
185e	E6 - Salt management in the pursuit of salt-tolerant potato	€ 0	€ 0	€ 0	€ 0	**€ 139**
185f	E7 - More fruit with less water	€ 63	€ 0	€ 215	€ 278	**€ 94**
185g	E10 - Area Freshmaker Exploration	€ 0	€ 0	€ 0	€ 0	**€ 30**
185h	E11 - Waterhouderij Walcheren Exploration	€ 50	€ 0	€ 420	€ 470	**€ 75**
185i	E12 - Drainstore	€ 124	€ 0	€ 124	€ 248	**€ 124**
185j	Additional resources for the Freshwater Supply testing ground	€ 626	€ 0	€ 626	€ 1,252	**€ 626**
Area around the major rivers						
186	MWS: study into longitudinal erosion control dams	€ 100	€ 0	€ 0	€ 100	**€ 100**
187	Launch of measures in area south of the major rivers	€ 250	€ 0	€ 730	€ 980	**€ 500**
188	Climate adaptation pilot regarding sustainable use of shallow groundwater	€ 100	€ 0	€ 200	€ 300	**€ 100**
Main water system (cf. measures outlined for each region)						
189	Water availability in the Main water system (MWS) (HWS)	€ 370	€ 0	€ 0	€ 370	**€ 1,200**
190	Smart Water Management (SWM)	€ 2,779	€ 0	€ 0	€ 2,779	**€ 4,912**
191	Noordervaart	€ 7,900	€ 0	€ 3,050	€ 10,950	**€ 9,000**
Total		**€ 89.240**	**€ 25.893**	**€ 160.043**	**€ 275,177**	**€ 152,315**

* The aggregate contributions from sources other than the Delta Fund. Arrangements regarding, inter alia, funding have been set down in Administrative Agreements on Freshwater Supply

** This column reflects the total grant earmarked for the first phase of the Delta Plan on Freshwater Supply, which runs from 2015 to 2021; some projects will run until 2023. The preceding columns reflect the expenditure planned for the years ahead.

Table 14: Additional measures prompted by the drought of 2018

Proposal submitted by	Project	Focused on	Cost (MM of euros)	Regions (MM)	Delta Fund Contribution
Elevated Sandy Soils	Comprehensive set, Eastern region Comprehensive set, Southern region	Zoetwatermaatregelen, zoals peiloptimalisatie, seizoenberging, efficiënter beregenen, conserveren op perceelniveau, water vasthouden op gebiedsniveau	8.0 8.0	6.0 6.0	2.0 2.0 (for urgent areas, including research)
	Drought study in six sandy provinces	Onderzoek naar mechanismen van droogte, gevolgen en effecten van maatregelen en mogelijkheden om te anticiperen			
West	Saline at a distance – Fresh on hand (Coastar)	Modelontwikkeling en toepassing voor grootschalige ondergrondse opslag van zoet water en toepassen op vier cases (Polder, Kust, Westland en Rotterdam)	2.0	1.7	0.3
IJsselmeer Region / West/ Southwest Delta	Saltwater mapping 1st phase	Elektromagnetische metingen van de ondergrond vanuit de lucht om zoet/zout grensvlak in de bodem in kaart te brengen	0	0	0.7
Drought Policy Platform: Rijkswaterstaat, district water boards, drinking water companies	1. IJsselmeer salt monitoring and model developmentr	1. Structural address of saltwater issues through measurement and modelling	1.5	0.5	1.0
	2. Setting up monitoring points and model validation in Amsterdam-Rijn Canal / Noordzee Canal, Hollandse IJssel, Lek	2. Structural address of saltwater issues through measurement and modelling	0.5	0.1	0.4
	3. Measuring network for elevated parts of the Netherlands	3. Measuring stations for soil moisture and current evaporation in the purview of groundwater management	0.6	0.4	0.2
	4. Various actions by Drought Policy Platform	4. Implementation of Drought Policy Platform actions; prioritisation scheme, factsheets, damage, navigable depths, fish migration, Lobith chloride content, et cetera.	0.5	0.1	0.4

CHAPTER 5

Spatial adaptation: progress and measures

Spatial adaptation in actual practice, Water Street pilot plant at Delft University of Technology

This chapter addresses the implementation of the Delta Decision on Spatial Adaptation (Paragraph 5.1) and the progress of the measures set out in the Delta Plan on Spatial Adaptation (Paragraph 5.2).

5.1 Delta Decision on Spatial Adaptation

The Delta Decision on Spatial Adaptation is aimed at securing a climate-proof and water-resilient spatial design in the Netherlands by 2050. To this end, the central government, provinces, municipalities, and district water boards will be taking a climate-proof and water-resilient stance with effect from 2020. They will be focusing on four themes: waterlogging, drought, heat, and the impact of urban flooding. Soil subsidence is adding to the spatial adaptation tasking, which is why it is a standard component in the stress tests and risk dialogues being conducted by the governments.

5.1.1 Progress in the Delta Decision

Stress tests and risk dialogues

The stress tests are being conducted as scheduled. The Delta Plan on Spatial Adaptation sets out that by no later than the end of 2019, all the governments in the Netherlands must have mapped out the vulnerabilities to weather extremes by conducting a stress test. By mid-2019, more than 90 per cent of the municipalities has satisfied this first Delta Plan ambition. This proportion is expected to increase by the end of 2019. Ambition 2 is for all the governments to have conducted risk dialogues before the end of 2020. A considerable number of local governments have already conducted such dialogues, but in many cases, they have not yet covered the entire municipality or the entire territory governed by the district water board or the province. Ambition 3 is to draw up an implementation agenda by no later than 2020. Many Working Regions have embarked on this ambition; several governments have already attained this goal.

The ambitions of the Delta Plan on Spatial Adaptation are being tackled by municipalities, district water boards, provinces, and the central government, which have joined forces in a range of bodies such as the 42 Working Regions (see Map 3). The Working Regions are monitoring and reporting on the progress made in their area. Their reports serve as the basis for the progress reports that the seven existing regional consultative bodies submit to the Delta Programme Commissioner. The monitoring process conducted in early 2019 showed that most of the Working Regions still lack the knowledge required to proceed to the steps that follow the stress test. The additional process support impulse – in the form of co-funding by the central and regional governments – is expected to change this. This impulse will boost awareness, the risk dialogue process, and the formulation of climate adaptation strategies and implementation agendas. This will provide a better picture of the climate adaptation taskings, which will enable their translation into concrete projects and amendments to management plans, with the associated budgets and capacities.

In addition, Rijkswaterstaat and the government rail transport agency ProRail are working on stress tests for the main roads, railways, waterways, and the main water system, in order to gain insight into the vulnerability of the national infrastructure.

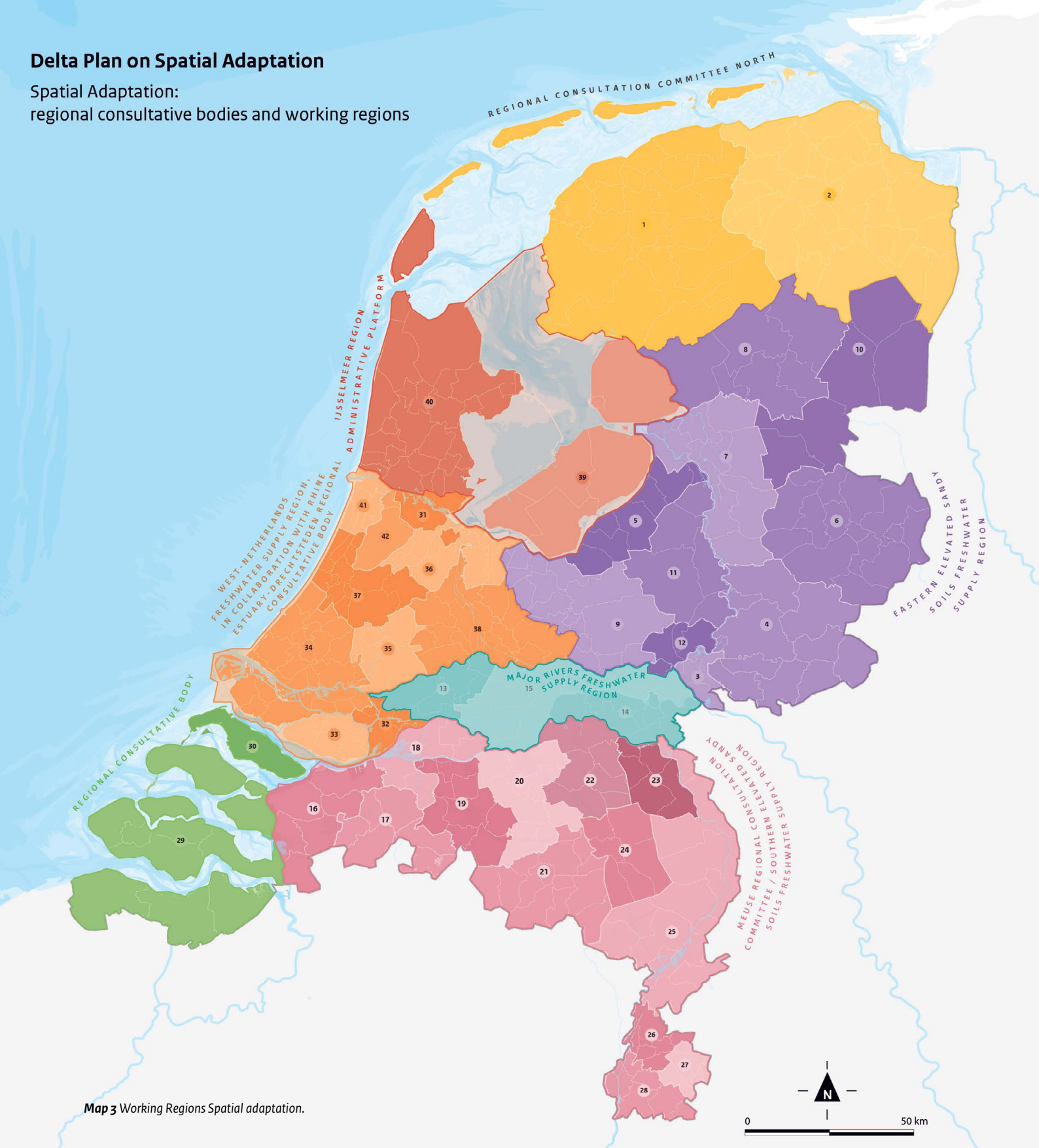
National vital and vulnerable functions

In 2019, the national strategy regarding the vital and vulnerable functions was expanded. Coordination within – and between – Ministries and sectors has been improved, whilst the vulnerability of vital and vulnerable functions is now also being reviewed at the local and regional levels. Interviews and working sessions have revealed a lack of clarity regarding the division of responsibilities between the parties involved, i.e., between the central and regional governments, and between public and private parties. Furthermore, the exchange of relevant (geo) data has turned out to be cumbersome, as in many cases this data is regarded as strategic and, therefore, “confidential”. However, such information is essential in the purview of a flood analysis.

The provinces of Gelderland and Limburg have conducted two pilots. The Ministries, sectors, regional and local governments involved have explored area-specific ways to improve the water resilience of vital and vulnerable functions. The studies tied in with the Flood Risks Impact Analyses conducted by the Security Regions, and with the climate stress tests and risk dialogues conducted by regional and local governments. The pilots have shown that it is important for the governments – preferably at the provincial spatial scale level - to collectively approach the grid managers and authorities in charge of the vital and vulnerable functions in the region. Obviously, in view of the national significance of vital and vulnerable functions, the central government remains a key discussion

Delta Plan on Spatial Adaptation

Spatial Adaptation: regional consultative bodies and working regions



***Map 3** Working Regions Spatial adaptation.*

Working regions

- 01 Frisian Water Chain Administrative Agreement
- 02 Groningen and North Drenthe water chain collaboration
- 03 De Liemers cooperative
- 04 Achterhoek+ region cooperative
- 05 North Veluwe water collaboration
- 06 Twente water grid
- 07 West Overijssel DP Spatial Adaptation
- 08 Fluvius
- 09 Vallei & Eem Water Platform
- 10 Northern Vechtstromen
- 11 East Veluwe water collaboration (SWOV)
- 12 Veluwe edge cooperative
- 13 Alblasserwaard-Vijfheerenland regional council
- 14 RAS Rijk van Maas & Waal cooperative
- 15 Rivierenland spatial adaptation (NWrR)
- 16 West water network
- 17 De Baronie water network
- 18 Working unit 4
- 19 Hart van Brabant
- 20 Working unit De Meierij
- 21 Waterportaal Zuidoost Brabant
- 22 As50+ water collaborative
- 23 Land van Cuijk
- 24 Brabantse Peel
- 25 Water Panel North
- 26 Western mining region
- 27 Parkstad
- 28 Maas & Mergelland
- 29 Zeeland regional cooperative
- 30 Goeree-Overflakkee Spatial Planning - Housing - Economy administrative platform
- 31 Amsterdam climate adaptation strategy
- 32 Spatial Planning - Housing - Economy administrative platform - Drechtsteden region
- 33 Spatial Planning - Housing - Economy administrative platform - Hoeksche Waard region
- 34 Spatial Planning - Housing - Economy administrative platform - Rotterdam - The Hague metropolis region
- 35 Spatial Planning - Housing - Economy administrative platform - Central-Holland region
- 36 Amstel, Gooi & Vecht region cooperative
- 37 Spatial Planning - Housing - Economy administrative platform - Holland Rijnland region
- 38 Utrecht Spatial Adaptation Coalition
- 39 Flevoland climate adaptation
- 40 Noorderkwartier water chain collaboration
- 41 South Kennemerland South
- 42 Climate-proof Haarlemmermeer

Regional consultative bodies

- Regional Consultation Committee North
- IJsselmeer Region Administrative Platform
- Eastern Elevated Sandy Soils Freshwater Supply Region
- West-Netherlands Freshwater Supply Region, in collaboration with Rhine Estuary-Drechtsteden Regional Consultative Body
- Major Rivers Freshwater Supply Region
- Southwest Delta Regional Consultative Body
- Meuse Regional Consultation Committee / Southern Elevated Sandy Soils Freshwater Supply Regiond

Basic map

- Freshwater
- Saltwater / brackish water
- Area outside the dykes
- Border

partner. Another finding involved the utilities (power, gas, telecom): the authorities in charge of each function should preferably be contacted separately, in order to uphold the confidentiality of geo data. Providing utility companies with detailed (flood) information in individual, tailored sessions will enable the managers to indicate which areas are prone to failure, without having to share geo information on objects. The results of the pilots will be collated in the second half of 2019, along with the experience gained by other provinces. They will be supplemented with recommendations regarding the review of the Delta Decision on Spatial Adaptation and submitted to the Spatial Adaptation Steering Group.

The fifth progress report on the Approach to national vital and vulnerable functions is contained in Background Document C.

Flood impact reduction

One of the taskings addressed by the Delta Programme is to ensure a spatial design that minimises the impact of urban flooding. This involves containment of damage and casualties, reduction of the recovery time after a flood, and the long-term minimisation, postponement or prevention of dyke improvements.
In 2018, the Flood Impact Reduction working group drew up an advisory report which has been adopted by the Delta Programme Steering Group. The Spatial Adaptation Steering Group is monitoring the progress made in the actions.

The Delta Programme Steering Group decision ensures that impact reduction remains a fully-fledged element of spatial adaptation. In 2019, the recommendations of the working group were integrated into the seven ambitions of the Delta Plan on Spatial Adaptation (see Figure 5). For example, in the purview of the stress tests, maps were added to the Climate Impact Atlas showing local flood probabilities for various water depths.

Water risk profile and water risk diagram

The incorporation of impact reducing measures in spatial planning calls for an assessment framework. In the absence of such, water risk profiles and water diagrams have been developed to be able to assess such measures nonetheless. The method has also been outlined in the guidelines to the standardised stress test with respect to spatial adaptation. The water risk profile provides an instant picture of the entire range of potential flood scenarios (main and regional water systems) for a specific location, as well as the waterlogging scenarios. A single figure reflects the occurring water depths and the associated return frequencies (see Figure 3).

Recommendations by the Flood Impact Reduction working group

The Flood Impact Reduction working group recommends:

- Water-resilient and climate-proof construction is a prerequisite for the sustainable development of the Netherlands. This prerequisite, which has already been incorporated into the Delta Decision on Spatial Adaptation[28], must be embedded in policy and concrete action by 2020.
- Climate Adaptation also comprises measures to minimise the impact of urban flooding or very serious waterlogging through spatial planning.
- To this end, flood impact reduction must be incorporated into new spatial developments, but also in restructuring projects, management, maintenance, (business) investments, and the formulation of contingency plans by both public and private parties.
- This requires, as a minimum, that:
  - flood impact reduction needs to become a fully-fledged element in the area-specific elaboration of the first three ambitions set out in the Delta Plan on Spatial Adaptation: the stress tests, the risk dialogues / definition of ambitions, and the implementation of actual measures. Essential in this respect is linkage between "layer 2" and "layer 3" (impact analyses conducted by the Security Regions), linkage with the national strategy regarding vital and vulnerable functions, and linkage with the strategy regarding waterlogging;
  - impact reduction needs to be embedded in policy and regulations (such as Environmental Visions), in order to generate transparent policy frameworks regarding impact acceptance levels, as well as a set of (preferably legally enforceable) instruments;
  - the central government, provinces, and municipalities are responsible for embedding such impact reduction in all the Environmental Visions, in order to ensure that (new) spatial developments will not cause higher casualty rates and/or greater economic damage, insofar as such is reasonably possible. Furthermore, the central government, provinces, municipalities, and water managing bodies need to ensure their continued involvement in the further elaboration of the Environmental Visions into plans and programmes.
- An essential factor is that impact reduction is not solely up to the public parties; it involves a collective approach and a shared responsibility of public and private parties, such as the vital and vulnerable sectors, project developers, and housing corporations.

[28] See DP2015, 2.4 Delta Decision on Spatial Adaptation.

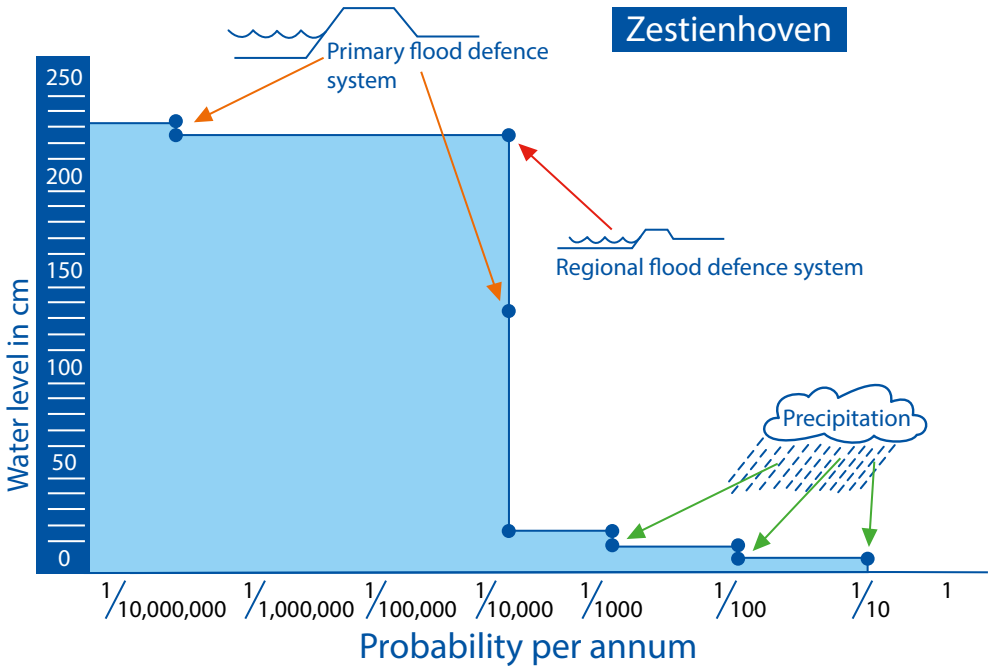


Figure 3 *Water risk profile.*

Subsequently, the water risk diagram (see Figure 4) is used to determine, in collaboration with object managers and experts, how the flooding will impact each function or type of object. The impact is divided into four categories:

- damage;
- casualties;
- societal disruption (number of break-down days x number of users);
- image (including environmental damage and other indirect effects).

The risk dialogue encompasses an estimation of the seriousness of the impact (catastrophic, serious, et cetera). The water risk diagram helps to determine the events for which measures are advisable, and which impact category is normative in that respect.

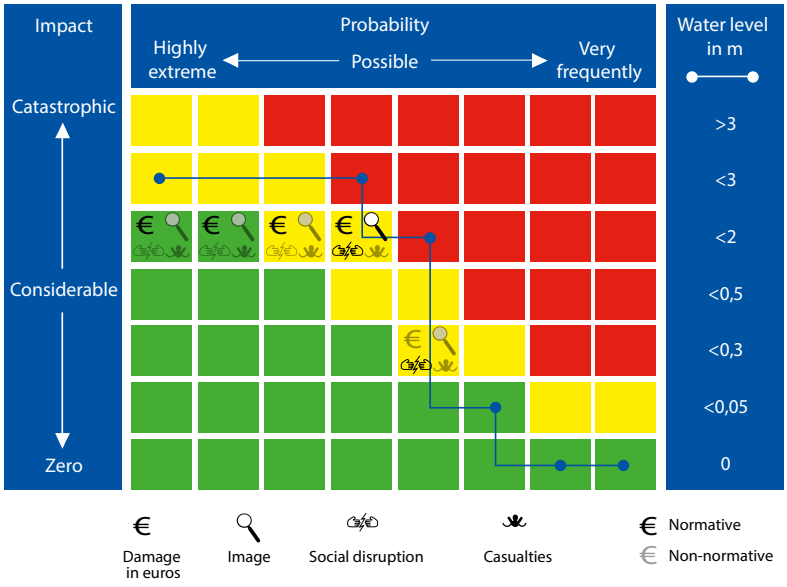


Figure 4 *Water risk diagram.*

Regional flood impact reduction programme in Utrecht

In 2018, the province of Utrecht initiated a regional collaborative to reduce the impact of urban flooding. Such impact has been mapped out and discussed with the municipalities. This has enhanced the sense of urgency and the willingness to participate in the collaborative. The regional programme was launched by signing the Utrecht Declaration of Intent regarding Multi-layer Flood Risk Management. The programme focuses on multi-layer flood risk management layers 2 and 3: the further development and implementation of spatial planning measures (layer 2), and contingency and disaster control (layer 3). The regional programme also addresses the recovery phase following a flood. Wherever possible, the structure of the collaborative ties in with the Working Regions. At the area level, it is being elaborated along the lines of regional tasking – regional ambition – action perspectives – policy embedding.

5.1.2 Potential amendments to the Delta Decision

DP2021 will comprise proposals for the review of the Delta Decisions and regional Preferential Strategies. DP2020 before you maps out the potential amendments, by way of a first step. The process is outlined in Chapter 2.

In 2017, the Delta Decision on Spatial Adaptation was evaluated, which led to the conclusion that acceleration and intensification of spatial adaptation efforts is imperative. This has constituted reason to draw up the Delta Plan on Spatial Adaptation, featuring the seven ambitions that are currently being realised.

In the wake of the ongoing review of the Delta Decision, potential interim goals for the period 2020-2050 are being explored, as is a more specific substantiation of the terms "climate-proof" and "water-resilient", in order to be able to assess whether the 2050 target regarding climate-proof and water-resilient spatial planning will be attained. Climate Adaptation is to become the "new standard" with respect to developments in the spatial domain, in order to ensure that the Netherlands will be as climate-proof and water-resilient as possible by 2050, whilst (re)developments will not entail any additional risk of damage or casualties, insofar as such is reasonably feasible. The review will also examine the relationship between climate adaptation and other taskings, such as the energy transition, the transition towards cyclic farming, the restoration of biodiversity, cultural heritage, and the housing tasking. Furthermore, the review will consider an expansion of the national strategy regarding vital and vulnerable functions: to cover not only urban flooding, but all climate threats, viz. also waterlogging, heat, and drought.

5.1.3 Knowledge and innovation

In 2019, additional funds were allocated to research. This provided additional impetus to the development and dissemination of knowledge. This same year saw the formulation of the Knowledge Strategy for the Delta Plan on Spatial Adaptation (DPRA), focused on the improvement of the knowledge infrastructure. The Knowledge Strategy facilitates the retrievability of existing knowledge, boosts the application of available knowledge, and promotes the development of knowledge regarding new issues. Within the context of the Knowledge Strategy, meetings are organised that are specifically focused on the development and exchange of knowledge. In addition, knowledge will be given a more prominent position in the Spatial Adaptation Knowledge Portal.

In 2019, the National Spatial Adaptation Team will be implementing the Research Programme DPRA 2019, comprising three focus areas:

1. Tool development (through NKWK-KBS Research Consortium)

Two tools were launched in the spring of 2019: the Climate Damage Assessor (KSS) and the Climate-proof City Toolbox (TKS). The KSS tool maps out the damage caused by climate change if no measures are taken. The TKS tool comprises measures, their effectiveness, and their cost. This tool can be used to draw in specific measures at specific locations, and to calculate their cost effectiveness. Both tools have been developed through the NKWK-KBS Research Consortium [NKWK stands for National Water and Climate Knowledge and Innovation Programme; KBS stands for Climate-proof City]. The tools are available free of charge at the Spatial Adaptation Knowledge Portal. The tools will be developed further in 2019, on the basis of user experience. In addition, a tool will be developed in 2019 for conducting a social cost-benefit analysis of adaptation measures.

2. System knowledge

Several exploratory studies are underway, regarding topics such as:

- climate adaptation and urban densification;
- accelerated rise in sea level and spatial quality;
- the integrated approach to climate adaptation and other societal taskings;
- concretisation of the terms of "climate-proof" and "water-resilient";
- the water requirements of urban areas with and without adaptation measures;
- behavioural changes.

3. Demand-driven research (through NKWK-KBS Research Consortium)

The Climate-proof Together Platform plays a key role in the collection of practical knowledge requirements. The DPRA Knowledge Strategy project team and the NKWK-KBS Research Consortium are collectively incorporating such requirements into a Knowledge Programme and research projects. Questions whose answers are still pending will end up on the NKWK-KBS Knowledge Agenda. In recent years, this agenda was established on the basis of a wide range of meetings and questions from actual practice.

Climate-proof Prins Bernhardstraat, Deventer

In the Prins Bernhardstraat in Deventer, practical research is being conducted into drainage variants, using the road foundations for storage purposes. Sections featuring different systems have been constructed in the street and their performance is being monitored. Opportunities for linkage with the heating grid are also being explored. The municipality of Deventer is conducting this research in collaboration with the Drentse en Overijsselse Delta district water board, the province of Overijssel, a consultancy firm, and the contractor.

5.2 Delta Plan on Spatial Adaptation: the measures to render the Netherlands climate-proof and water-resilient

The Delta Plan on Spatial Adaptation comprises the measures aimed at rendering the Netherlands climate-proof and water-resilient, with a focus on seven ambitions (see Figure 5).

Figure 5 *The 7 ambitions of the Delta Plan on Spatial Adaptation.*

5.2.1 Mapping out vulnerability

By mid-2019, more than 90 per cent of the municipalities had satisfied this first Delta Plan ambition. This proportion is expected to rise even further by the end of 2019.

In January 2019, new standards were introduced for the stress tests regarding waterlogging, heat, drought, and the impact of urban flooding. Several standards were published in the form of maps contained in the Climate Impact Atlas; areas that have already conducted a stress test can simply set the new standards and their own results side by side. The standards will continue to be developed on the basis of input such as user experience and user requirements. New scientific insights, such as the 2021 KNMI scenarios, may also result in amendments.

Goeree-Overflakkee Stress Test

The municipality of Goeree-Overflakkee aims to properly prepare for a more extreme climate. In collaboration with the province of Zuid-Holland and the Hollandse Delta district water board, the municipal authorities have compiled reports, measurements, and expertise (as generated by, e.g., the provincial Climate Impact Atlas Zuid-Holland) into the Goeree-Overflakkee Stress Test. For example, the stress test identifies the locations prone to sewer overflow during extreme downpours, and locations at which the water quality could be compromised following a prolonged period of extreme heat. It also reflects what warmer and sunnier weather will entail for the leisure sector and for local residents. The municipality will use the stress test to enter into a dialogue with various parties on the island regarding ways to minimise the negative impact of climate change and to benefit from its positive effects.

The standards should not be regarded as spatial adaptation regulations. The stress test provides a picture of an area's vulnerability. This picture is used to set down a regional ambition by reference to risk dialogues. Nor do the standards constitute a ready-made DIY kit; a range of considerations are needed. For that reason, guidelines have been drawn up: a compilation of instructions for conducting the stress test and for the interpretation and application of the outcomes. The guidelines support the choices to be made: for which measures is it important to know the financial consequences? How thorough will such calculations need to be, and why? What information is required? How are uncertainties dealt with? Such choices may dictate additional customisation, as some regional differences are not covered by standards.

Climate Impact Atlas

The Climate Impact Atlas is a public website. Its information provides an initial picture of a particular area's vulnerabilities to weather extremes and climate change. Several knowledge institutes and consultancies are involved in the Climate Impact Atlas, and the available maps are based on the most recent climate scenarios. The insights into the impact of climate change are regularly updated. For example, in 2018, new precipitation maps were incorporated. Low-threshold, public tools such as the Climate Impact Atlas are of particular importance for small municipalities. Such tools enable them to satisfy ambition 1 – mapping out vulnerabilities – of the Delta Plan on Spatial Adaptation. Foundation CAS, the body responsible for maintaining the Climate Impact Atlas, supplies customised GIS data free of charge. The Climate Impact Atlas will be updated in the second half of 2019.

Fryslân Stress Tests

The Fryslân Working Region completed its stress tests in 2018 and incorporated the results in the Frisian Climate Impact Atlas. This atlas, which is still under development, will be used for the climate dialogues to be conducted in 2019. Their outcomes will serve as input not only for the water and climate policies pursued by the various partners, but also for the Frisian Climate Adaptation Strategy. The Strategy sets out solution strategies and steers the embedding of spatial adaptation in (Environmental) Visions, policy, and projects. The aim is to tie in with existing developments and processes, wherever possible, and to utilise existing networks. The parties intend to integrate spatial adaptation into policy and projects as soon as possible, and to develop a perspective of a liveable province of Fryslân with 2100 as its horizon.

5.2.2 Conducting risk dialogues and drawing up strategies

In addition to the central government, many municipalities, district water boards, and provinces have already conducted risk dialogues or have embarked on the preparations. Expectations are that virtually all the partners will have conducted risk dialogues by 2020. The results of the stress tests constitute the basis for the dialogues. A risk dialogue raises awareness: the realisation that an area may be vulnerable to climate extremes. The participating parties discuss how to prevent such vulnerabilities and which concrete measures will be feasible. They also address opportunities for attaining other goals – such as enhancing an area's liveability, the energy transition, the restoration of biodiversity, and fostering sustainable farming. It is important for residents and businesses to participate in the risk dialogues. After all, more than half of the Netherlands is in private hands. The outcomes of the risk dialogues are set down in agreements. All the governments must have conducted a risk dialogue by no later than the end of 2020.

The risk dialogues revolve around organisation, communication, and participation. The National Spatial Adaptation Team collects and develops instruments to help prepare and conduct risk dialogues, and which can be used to set down the results. In 2018, an exploratory study was conducted into the manner in which governments want to be supported in conducting risk dialogues. The outcomes of this study – and the experience gained through meetings and campaigns launched under the Delta Plan on Spatial Adaptation – constitute the basis for a number of instruments. The Spatial Adaptation Knowledge Portal features a page on risk dialogues, providing an explanation, tips, and best practices. This information was expanded in 2019. Knowledge on risk dialogues is actively shared via the Climate-proof Together Platform, several networks (such as the Climate Adaptation City Deal and the KANS network, a cooperative of municipalities in the field of climate adaptation) and the Working Regions. Under the incentive programme, governments may be provided with concrete process support. In the second half of 2019, "guidelines for risk dialogues" will be published, comprising an interactive environment to guide governments through the three steps: *Prepare*, *Conduct*, *and Complete*. The guidelines provide answers to questions regarding potential risks, the assessment of such risks, capitalising on opportunities, the efforts required, and the strategic choices that can be made.

The Cultural Heritage Agency of the Netherlands (RCE) and the Foundation for Applied Water Research STOWA are compiling an Urban Genesis manual, in which the soil, subsoil, and water systems are linked to the built-up area. They are first conducting an exploratory study in collaboration with the pilot cities of Breda, Culemborg, Nijmegen, Haarlem, and Amersfoort. The manual will be published by the end of 2019, in the form of a workbook for a government training course.

Groningen risk dialogue

In the municipality of Groningen, five meetings were held to discuss the results of the stress test with representatives of a wide range of sectors, with a deliberate focus on larger organisations rather than local residents. Awareness occupied centre stage in the discussions. Subsequently, a participation process was initiated to collectively set down an ambition and a strategy. In addition to the larger organisations, residents and entrepreneurs are also involved in this process. The aim is to adopt a neighbourhood-level approach and, wherever possible, link up with the neighbourhood energy plans.

Rotterdams Weerwoord

With the Rotterdams Weerwoord Urgency Document and the associated collective declaration of intent, the municipality of Rotterdam, the Schieland en de Krimpenerwaard district water control board, the Hollandse Delta district water board, the Delfland district water control board, and Evides Water Company have taken another step towards the city's climate adaptation strategy. In the document, they set out ambitions and goals for climate-proofing the city of Rotterdam based on new climate insights and stress tests. In the period ahead, the ambitions and goals will be elaborated, together with many parties in the city, into measures to be implemented by public and private parties, either individually or collectively. The ambitions that have been set down are focused on frameworks for the planning of public space, schools, and sports fields; the embedding of climate adaptation considerations in processes, organisations, innovation, and model projects; risk dialogues and a neighbourhood-level approach; broad-based communication; a new incentive scheme; regulations and agreements; the exchange of knowledge and (inter)regional collaboration; and multifunctional rooftops.

5.2.3 Drawing up implementation agendas

The aim of the Delta Plan on Spatial Adaptation is for the governments to draw up implementation agendas by no later than 2020. The implementation agenda comprises a schedule and a budget with respect to the measures required for the realisation of the ambitions identified in the risk dialogue. The collective implementation agendas will generate a nationwide picture of the climate adaptation taskings.

Southern Netherlands Implementation Programme 2.0

Regional authorities in the southern part of the Netherlands are working on the Southern Netherlands Implementation Programme 2.0 as the next step in climate adaptation. The programme builds on the implementation agenda 1.0 in an adaptive manner, and maps out examples, progress, intended measures, and knowledge requirements. It aims to increase the involvement of municipalities and Working Regions in the implementation of climate adaptation.

Climate-resilient Hoogeveen

In 2018, the municipal council of Hoogeveen adopted the "Climate-resilient Hoogeveen" vision. The vision encompasses an implementation programme ("acting without a vision is dumb, yet a vision without acting is possibly even dumber"). The implementation programme covers climate-proofing of the LIOR guidelines[29] or civil engineering standards; the construction of a water grid from the city centre to the outskirts; and the amassing of climate-adaptation strategies and efforts by fieldworkers and neighbourhood managers.

[29] Guidelines for the planning of public space.

Cultural Heritage as a source of knowledge for an integrated approach

Heritage plays a key role in the identification of vulnerabilities and the exploration of spatial solutions. The Cultural Heritage Agency of the Netherlands has developed several tools for this purpose. The Water Poster indicates how heritage managers can protect their heritage and collections against water. The Water Storage map shows historic spatial solutions to waterlogging (water courses, urban development). Another tool involves a step by step plan for the utilisation of cultural history as a source of knowledge for vulnerability analyses and finding appropriate spatial adaptation measures. The Cultural Heritage Agency tools are linked to the stress test guidelines and available on the Spatial Adaptation Knowledge Portal website.

5.2.4 Capitalising on linkage opportunities

Increasingly more authorities are considering smart linkage of climate adaptation measures to other taskings in the physical environment. Especially in urban areas, such linkage opens up a host of opportunities: it may expedite the implementation of measures, reduce nuisance for residents and businesses, and yield financial benefits.

The "linkage" ambition is a logical element in the other ambitions set out in the Delta Plan on Spatial Adaptation. Linkage is one of the topics addressed during risk dialogues, which in addition to spatial adaptation also deal with the interconnectivity with other societal taskings at the street, neighbourhood, and regional levels. The Impact Projects carried out under the Incentive Programme show fine examples, such as linking climate adaptation to the construction of heat grids.

Nieuwdorp Climate Street (impact project)

The Prinses Margrietstraat and the Hertenweg in Nieuwdorp (municipality of Borsele) are to become the first climate streets in the province of Zeeland featuring only energy-neutral homes and a design capable of coping with both torrential rain and extreme drought. Residents, municipal authorities, and other parties involved are exploring options in concert.

Multifunctional water storage in Wolvega

The city of Wolvega has created a new water storage facility, with room for nature and leisure activities. The project involved collaboration between the province of Fryslân, the Wetterskip Fryslân district water board, the municipality of Weststellingwerf, and It Fryske Gea. The process spanned a period of twelve years; the water storage facility was put into service in 2017. Since then, water drainage in Wolvega has significantly improved. The construction of the water storage facility cost less than the construction of a larger sewer pipe. Furthermore, the storage pond purifies rainwater and generates a beautiful nature reserve, offering a lot of room for leisure activities. In consultation with the residents of an assisted living complex, a wide path was created for wheelchair users.

Heritage Deal links spatial taskings

On 21 February 2019, several governments and NGOs signed the Heritage Deal. This sets out agreements on the use of heritage in current major spatial taskings: the energy transition, sustainability, climate adaptation, urban growth, and depopulation. In the period 2019-2022, the Ministry of Education, Culture and Science is allocating 20 million euros to finding solutions to these types of challenges. Attention will also be paid to cultural heritage as a design driver. Municipal and provincial authorities will double this sum to a total of some 40 million euros.

An example of the use of cultural heritage for climate adaptation purposes is the reuse of locations and methods from the past, such as employing water mill ponds for water storage.

Soil subsidence in Gouda tackled collectively

The inner city of Gouda has been suffering from soil subsidence for ages. In some parts of the city, this is causing a great deal of trouble. Without subsoil and structural measures, an increasingly wider area will be affected. The formulation of a sustainable strategy involves a whole range of aspects, such as (ground) water management, sewerage, healthcare, economic development, leisure activities, the foundation of historic buildings, and the energy transition. The government does not bear sole responsibility for these aspects, as some two-thirds of the inner city surface area is in private hands. Ergo, it involves collective taskings, whilst standards are few and far between. In Gouda, the key issues are the future quality of living and working desirable for the inner city, and how the cost of measures can be divided in a socially acceptable manner. In the parts of the city centre that are already affected by soil subsidence, concrete – temporary – solutions are being pursued collectively. Inner city residents and entrepreneurs are being involved in the selection of solutions. The strategy will ultimately be set down by the district water control board and the municipal council.

5.2.5 Promotion and facilitation

The Minister of Infrastructure and Water Management has allocated additional funds to the promotion and facilitation of climate adaptation: a total of 20 million euros for 2019 and 2020. This sum is supplementary to the ongoing incentive programme. It is intended for process support, pilot studies, knowledge development, and knowledge sharing. The knowledge acquired will be made available through the Knowledge Portal and the Climate-proof Together Platform.

In addition, the central government is working on an amendment to the Water Act. This amendment will enable the allocation of Delta Fund grants to regional and local governments, earmarked for the implementation of measures to combat waterlogging. Furthermore, a temporary incentive scheme is being prepared. This will set out the measures and provisions for which grants may be awarded, and specify the conditions to be satisfied by regional and local governments in order to qualify for such grants. The amendment and the temporary incentive scheme are expected to come into force on 1 January 2021.

Process support

The “regional impetus process support” scheme is intended to expedite climate adaptation efforts in the regions. Regional and local governments can use these additional grants to support the first three ambitions set out in the Delta Plan on Spatial Adaptation: conducting stress tests, conducting risk dialogues, and drawing up a strategy and implementation agenda. Sixty-six applications have been submitted, which amply exceeded the available budget, i.e., a total sum of 6 million euros. Consideration of the proposals resulted in the acceptance of forty-seven applications. The National Spatial Adaptation Team is monitoring the implementation of the process support scheme; best practices and the knowledge gained will be

shared through the Knowledge Portal and the Climate-proof Together Platform.

Implementation project pilots

Funds have been set aside for the initiation of implementation pilots to support regions that have already mapped out their adaptation taskings. These pilots are intended to acquire practical know-how regarding the (implementation) process and the effectiveness of measures. The knowledge acquired will be of benefit to the other regional and local governments. The central government grant will cover a maximum of 50 per cent of the overall project costs. Three pilots have been selected for 2019:

- climate-adaptive restructuring of several types of residential areas in the Utrecht region;
- linkage opportunities for the climate-adaptive design of the natural gas-free Paddepoel district in Groningen;
- Meerssen regional strategy.

A sum of 5.2 million euros is available for these pilots. The tender procedure for the implementation project pilots to be carried out in 2020 will commence in November 2019; a sum of 4.8 million euros is available to this end.

Financial incentives

Financial incentives may induce residents and businesses to climate-proof their own premises. According to a 2018 feasibility study among municipalities, district water boards, and provinces, such schemes are garnering considerable attention among regional and local governments. In the spring of 2019, four pilots were launched – in Son en Breugel, Dordrecht, Rucphen, and Rotterdam in collaboration with the Delfland district water control board – involving experiments with the differentiation of sewerage charges and with greening grants. A tender procedure for another four pilots will start in October 2019. A sum of 80,000 euros has been set aside to this end. The results will be available by the end of 2020. In June 2019, nine municipalities and district water boards had joined the Financial Incentives for Climate Adaptation Alliance. In this Alliance, they learn from one another and from the experience gained in the pilots, and collectively elaborate research questions, such as: how are properties assessed, how can the selection of a proper mix of measures be simplified, and how is the effectiveness of such measures verified? Have the measures prompted a change of behaviour among residents and businesses?

Impact projects

In 2019, the eight Impact Projects scheduled in the fourth round of the Incentive Programme will show how the climate adaptation dialogue proceeds. The projects are examples of strategies targeting specific streets, neighbourhoods or areas, in which climate adaptation is a standard element. A grant of 25,000 euros per impact project aids the implementing governments, whilst the results inspire other governments. A case in point is the linkage of climate taskings to other societal and spatial taskings, and the challenge of embedding this linkage in regular processes and area development plans. Most of the Impact Projects revolve around the collective consideration, from each individual perspective, of risks, measures and their affordability. The Design Thinking impact project was completed in the first half of 2019. It has produced concrete examples of the manner in which risk dialogues are being conducted in Noord-Brabant. The other Impact Projects are still in progress.

Climate-proof Together Platform

The Climate-proof Together Platform is an important link between policy and actual practice. The platform was set up in 2018 and the positive experiences have resulted in a decision to continue the activities up to and including 2020. To this end, the Ministry of lnfrastructure and Water Management has set aside funds from the supplementary incentive of 20 million euros. The Climate-proof Together platform provides support at the local level, liaises, and ensures expansion to the national level. On the one hand, the platform supplies practical insights in the purview of national policy development; on the other, it translates national policy lines and agreements – such as those pertaining to the construction of Working Regions and conducting risk dialogues – into local situations.

The Climate-proof Together Platform is contacted by parties from all across the Netherlands. Many municipalities, district water boards, and provinces pose questions regarding the expansion of climate adaptation: from one municipal service to other services, from the government to private parties, from projects to programme management. With respect to FAQs, the platform aims to boost the dissemination of best practices, for example, regarding ways in which municipalities or district water boards may promote climate-proof garden initiatives, or regarding actions that housing corporations may take towards their tenants. Such “theme-based sprints” are undertaken in collaboration with the sectors concerned, in order to ensure that knowledge is upscaled through the end users’ natural channels. The Climate-proof Together Platform is the logical discussion partner for parties that are relatively unfamiliar with the climate adaptation network, such as associations of insurance companies, home owners, and garden centres.

In 2019, many questions pertained to risk dialogues, the application of the Environment Act, and the integration of the energy transition and climate adaptation. A risk dialogue requires customisation, which is why the Climate-

proof Together Platform focuses on the exchange of comparable situations and experiences, to enable everyone to find tailored best practices. A key result of Climate-proof Together is the enhancement of the direct interaction between climate adaptation professionals, in various ways: through regional events, social media, forums, and other channels. This infrastructure will be further expanded in 2020.

Knowledge Portal

The Spatial Adaptation Knowledge Portal is an important source of information for everyone engaged in climate adaptation. The website contains practical information, tools, examples, and news releases. The portal attracts an average of 500 visitors a day; last year, the number of questions submitted to the Helpdesk doubled to nearly 300. In early 2019, the website was improved on the basis of experience, user meetings, and the questions received by the Helpdesk. Furthermore, recent products have been added, such as the guidelines for standardised stress tests, information on risk dialogues, the reformed Incentive Programme, and tools such as the Climate Damage Assessor and the Climate-proof City Toolbox (both developed by the National Water and Climate Knowledge and Innovation Programme).

In 2019, the Portal will be focusing on enhancing awareness of the seven ambitions of the Delta Plan on Spatial Adaptation. Most of the information will also be available in English, in order to accommodate questions from abroad regarding the Dutch experience in the field of portals. Knowledge on this topic will be exchanged during meetings and conferences across the globe.

The information on the National Climate Adaptation Strategy (NAS) continues to be expanded with data on, e.g., the impact of climate change on various sectors; information on climate adaptation dialogues, and news on the LIFE IP application. The (interactive) NAS adaptation tool, which was launched at the end 2018, visualises the impact of and risks entailed in climate change, and enables users to create a customised visualisation.

These learning experiences are being upscaled to the (inter) national level through the agency of umbrella organisations (Association of Netherlands Municipalities, Association of Dutch Regional Water Authorities, and Association of Provincial Authorities), the RIONED Foundation [interest group for urban drainage issues], the Foundation for Applied Water Research STOWA, and the Climate Adaptation City Deal. Under the European Interreg project BEGI, 16 partners from seven countries have joined forces to remove barriers in the fields of co-creation and the support of societal initiatives. The city of Dordrecht is a Lead Partner of this project.

Climate Adaptation City Deal

The Climate Adaptation City Deal is a component of the Dutch Urban Agenda: a collaborative of the central government, cities, provinces, and civic society partners, aimed at enhancing growth, innovation, and the liveability of Dutch cities. The Climate Adaptation City Deal is focused on achieving a breakthrough in urban climate adaptation efforts. In concrete projects, the parties are working on new forms of governance, new funding constructions, and innovative solutions to climate adaptation issues. Some projects mainly revolve around the combination of know-how and experience, others are focused on collective experimentation and giving impetus to innovations. The City Deal comprises four theme-based working groups: Climate-resilient Area Development, Society in Motion, Nature Based Solutions, and Multi-layer Flood Risk Management. September 2018 – midway through its four-year lead time – saw the publication of the magazine entitled "Het klimaat in 10 steden" [The climate in 10 cities]. It sets out the ambitions for the remaining two years.

Within the context of the Value of Urban Green and Blue City Deal, several models have been developed to map out the societal benefits of green and blue in cities. Within this City Deal, the TEEB city tool and the Natural Capital Atlas will be developed further, integrated wherever possible, and combined in the Green Benefits Planner in order to optimise their alignment with actual practice. The ultimate goal is to employ the tools to take more explicit account of the benefits of green and blue in the consideration of climate-proof urban renovations.

Dordrecht Living Lab

Dordrecht was officially designated as a Living Lab on 17 May 2017. The Hollandse Delta district water board, the province of Zuid Holland, and the municipality of Dordrecht have joined forces to climate-proof the Eiland van Dordrecht island, using a combination of research, innovation, and actual practice in the field of green-blue measures. The goal of Dordrecht Living Lab is to develop and apply new procedures and to acquire knowledge within the framework of the "pilot paradox": not every pilot will result in a structurally different method of operation. An evaluation by Erasmus University Rotterdam has produced several lessons: ensure proper liaison between the organisations involved and the pilot; keep an eye on the relationship with policy; demarcate the pilot; set aside sufficient resources in a timely manner.

5.2.6 Regulating and embedding

Monitoring has shown that, in all probability, a number of municipalities will not have embedded spatial adaptation in their policy documents by 2020. It is expected that they will hold off until the Environmental Visions are drawn up. By no later than 2022, regional and local governments must explore whether regional and local regulations need to be amended in order to attain the goal. In 2018 and 2019, the central government has explored, in collaboration with regional and local authorities, whether (construction) regulations act prohibitively on climate-proof planning. According to this study, current national-level **laws and regulations** do not pose a hindrance to climate-proof construction and development. Municipalities, in particular, have ample scope for "arranging" and setting down regulations regarding climate-adaptive construction and planning. The fact that they fail to take (sufficient) advantage of such opportunities can be attributed to several causes, in particular: a lack of awareness of the scope of local and regional regulations with respect to climate-adaptive construction, the lack of a sense of urgency, and a lack of the required capacity. This will be remedied by, inter alia, drawing up guidelines for regional and local governments in 2019. The governments and private parties in the province of Zuid-Holland have set down the Climate-adaptive Construction covenant. Thus, they aim to accomplish that climate-adaptive construction will become the "new standard".

Zuid-Holland Climate-adaptive Construction covenant

Wherever possible, new development locations in the province of Zuid-Holland will be climate-adaptive, in order to be able to cope with weather extremes caused by climate change. A wide range of parties have embraced this ambition by signing the Climate-adaptive Construction covenant in October 2018: construction companies, municipalities, provincial authorities, district water boards, NGOs, financiers, and project developers. The Zuid-Holland coalition will take the lead in the collective acceleration, development of new design principles and standards, promotion of innovations, and facilitation of more testing grounds. To give additional impetus to the efforts, the coalition aims to realise a comprehensive reform, from converting "traditional tender procedures" to new funding methods such as a climate mortgage.

Policy is fleshed out in **visions and plans**. The National Environmental Vision ensures coherence between climate adaptation policy and the policy addressing other societal national taskings involving the physical environment. Provincial and municipal Environmental Visions, in their turn, open up a host of opportunities in the move to foster spatial adaptation through green-blue measures. In terms of content, large differences can still be observed in the municipal and provincial Environmental Visions. Some have already properly incorporated spatial adaptation, whilst others are failing to address spatial adaptation at all. In order to give residents and municipalities an even better picture of the opportunities that the Environment Act offers for green-blue measures, the brochure on groundwater issues in Environmental Visions will be amended. For the benefit of regional and local governments, the aforementioned manual for climate adaptive construction and development will be published. This manual will assist them in drawing up Environmental Visions that incorporate spatial adaptation goals and ambitions, in interconnection with plans for, e.g., the public space, the energy transition, construction, the vitality of rural areas, and municipal bye-laws.

Zwolle: adaptation strategy and the Environment Act

In 2017, the municipal council of Zwolle endorsed Part 1 of the Environmental Vision, which included climate adaptation goals. In addition to risk containment, these goals also pertain to the capitalisation of innovation opportunities and the greening of local environments. The goals have been elaborated in an adaptation strategy (to be endorsed in the summer of 2019). One aspect concerns rules and regulations. The municipality can impose short-term measures either through a tailored regulation or through a "bye-law regarding rainwater and groundwater drainage". The authorities will only impose such measures if so dictated by a demonstrable, collective risk of private damage, and where public space measures are inadequate. This is the outcome of a local participation process, in the spirit of the Environment Act. The new regulations will be embedded in the updated zoning plans and in the Environment Plan. A study will need to be conducted to establish which rules are most effective and "enforceable".

To a significant extent, practical implementation is dictated by **standards**. This extends to, e.g., building constructions, utility meter rooms, pumping stations, sewerage systems, road designs, but also risk and asset management. In this respect, "standards" are understood to mean: best practices, guidelines, manuals, instructions, protocols, and practical standards (such as developed by the Dutch standardisation organisation NEN) that define design, construction, and management practices, and that are regularly decisive in the formulation of contracts. Most standards have been developed on the basis of practical requirements and are broadly supported. Some such standards have also been set down in law.

In 2019 and 2020, the National Spatial Adaptation Team will facilitate and promote – in collaboration with the National Climate Adaptation Strategy Team – the Climate Adaptation Standards Consultation Committee. Several parties are represented on this body: standardisation organisations, principals and contractors, knowledge and research institutes, and other stakeholders.

Rijkswaterstaat is already factoring in changing weather conditions in the design of dry infrastructure. Guidelines for rainwater drainage have been adapted to recent precipitation statistics, whilst climate adaptation has been accommodated in the MIRT guidelines for Sustainability. According to the KNMI climate scenarios, weather extremes will increase even more in the future. The Climate-proof Networks project is mapping out the impact on the national motorway system, the national waterway system, and the national water system, on the basis of specific stress tests and risk dialogues.

5.2.7 Responding to calamities

No matter how well we adapt our environment to extreme weather conditions, we will always have to reckon with the risk of an even more severe downpour or even more extreme drought. In such cases, proper contingency plans can contain the impact of extreme weather. That is why the Delta Plan on Spatial Adaptation also focuses attention on the response to calamities.

Meerssen

Following severe waterlogging and urban flooding in recent years, the municipality of Meerssen and the district water board have joined forces with the two Limburg Security Regions and several other municipalities in the purview of communication with residents. The governments have developed a campaign that, in a low-threshold manner, offers perspectives for action in the cold phase (preventative), and in the lukewarm and warm phases (during calamities). Their primary goal is to raise awareness and to foster individual and collective coping capacities. The campaign website, wachtnietopwater.nl (in Dutch), has been operational since the summer of 2019.

KNMI seeking to improve extreme precipitation predictions

Preparing for extreme weather is easier if you know it is coming. For that reason, the Royal Netherlands Meteorological Institute KNMI is working on improved forecasts for extreme rainfall. The project is aimed at predicting earlier – and with greater accuracy – which locations will be affected by extreme precipitation. In addition, KNMI is developing a warning instrument that other parties can customise for specific users. The project will be completed by 2021.

Damage prevention – through spatial adaptation – and damage insurance are interrelated. Traditionally, in the Netherlands the focus is on the prevention of damage. The downside of this approach is that the parties involved tend to assume that weather extremes will no longer cause problems and damage, once they have taken adaptation measures. However, weather conditions that are even more extreme than what such measures are designed for can never be ruled out. This is an important topic to address during the risk dialogue. Other topics include what is covered by the government's duty of care, and what can or cannot be insured. This is added to the risk dialogue roadmap, along with an overview of insurable and non-insurable aspects of climate damage.

The National Spatial Adaptation Team is also compiling an overview of action perspectives during and after a calamity in order to further reduce the residual risk for residents and businesses.

CHAPTER 6

Delta Fund

Pannerdensch Canal water control structure, October 2018

This chapter provides insight into the financial security of the Delta Programme, by comparing the resources available in the Delta Fund to the expected financial scope of the Delta Programme taskings.

The Delta Programme features measures that are funded entirely or partially from the Delta Fund: the measures pertaining to flood risk management and freshwater supply for which the central government bears (partial) responsibility. In addition, the Delta Programme comprises measures for which the central government does not bear responsibility, such as measures involving the regional water system and measures to combat waterlogging.

The paragraphs below successively outline the developments in the Delta Fund, the resources contributed by the other Delta Programme partners, and the financial taskings of the Delta Programme up to 2050.

6.1 Developments in the Delta Fund

The Delta Fund contains financial resources which the central government has earmarked to fund investments in flood risk management, freshwater supply, and water quality, and the associated management and maintenance by the central government. The Delta Fund can also provide grants for measures in the fields of flood risk management, freshwater supply, and water quality implemented by other governments (see Article 7.22d, second paragraph, of the Water Act). Water quality only comes to the fore in this analysis in interconnection with the Delta Programme taskings (flood risk management and freshwater supply). The Delta Plan on Flood Risk Management, the Delta Plan on Freshwater Supply, and the Delta Plan on Spatial Adaptation contain an overview of all the studies conducted and the concrete measures scheduled under the Delta Programme, including the budget allocated.

Budget amendments involving several projects scheduled under the Delta Plan on Flood Risk Management have been incorporated into the draft Delta Fund 2020 budget. Resources that have become available in the Room for the River project, the Meuse Projects, and the Varik-Heesselt project have been added to the non-allocated budget available for investment up to and including 2032. New reserves have been included/raised under the non-allocated budget available for investment up to and including 2032, among which 257 million euros for the Major Waters Programme Strategy, 80 million euros for Integrated River Management, and 18 million euros for the Statutory Assessment Tools 2035. These reserves will also be (partially) extrapolated to the year 2033.

The implementation of the Delta Plan on Freshwater Supply is in full swing. The first round of freshwater supply measures is in progress, and a sum of 150 million euros from the Delta Fund has been set aside for a second round of measures. The drought of 2018 has prompted the Minister of Infrastructure and Water Management to allocate 7 million euros to the implementation of measures in the worst-hit areas, and to conducting additional monitoring and research in the purview of addressing salt issues and groundwater management.

The central government is preparing an amendment to the Water Act, encompassing a temporary incentive scheme to cover Delta Fund grants for measures to combat waterlogging. Co-funding is a precondition of qualifying for such grants.

Delta Fund budgets

In the period 2020-2033, a sum of some 17.9 billion will be available in the Delta Fund, which brings the annual budget to an average of nearly 1.3 billion euros. This is evident from Table 15, which reflects the itemised and total Delta Fund budgets for the budget year 2020 and the period 2020-2033. Figure 6 reflects the itemised development in the budgets for the years up to and including 2033.

Table 15: Budgetten Deltafonds in 2019 en in totaal op basis van de Ontwerpbegroting 2020 (in miljoenen €)

		2020	totaal (2020-2033)
Art. 1	Flood risk management investments	462.4	6,568.5
Art. 2	Freshwater supply investments	27.5	78.0
Art. 3	Management, maintenance, and replacement	133.3	2,733.3
Art. 4	Experiments	13.0	902.4
Art. 5	Network-related expenses and other expenditure *of which Investment scope*	328.8 17.5	5,685.1 1,174.6
Art. 6	Contribution from other national budgets	-	-
Art. 7	Water quality investments	127.5	770.1
Total expenditure under Delta Fund		**1,105.0**	**17,911.9**

Delta Fund budgets

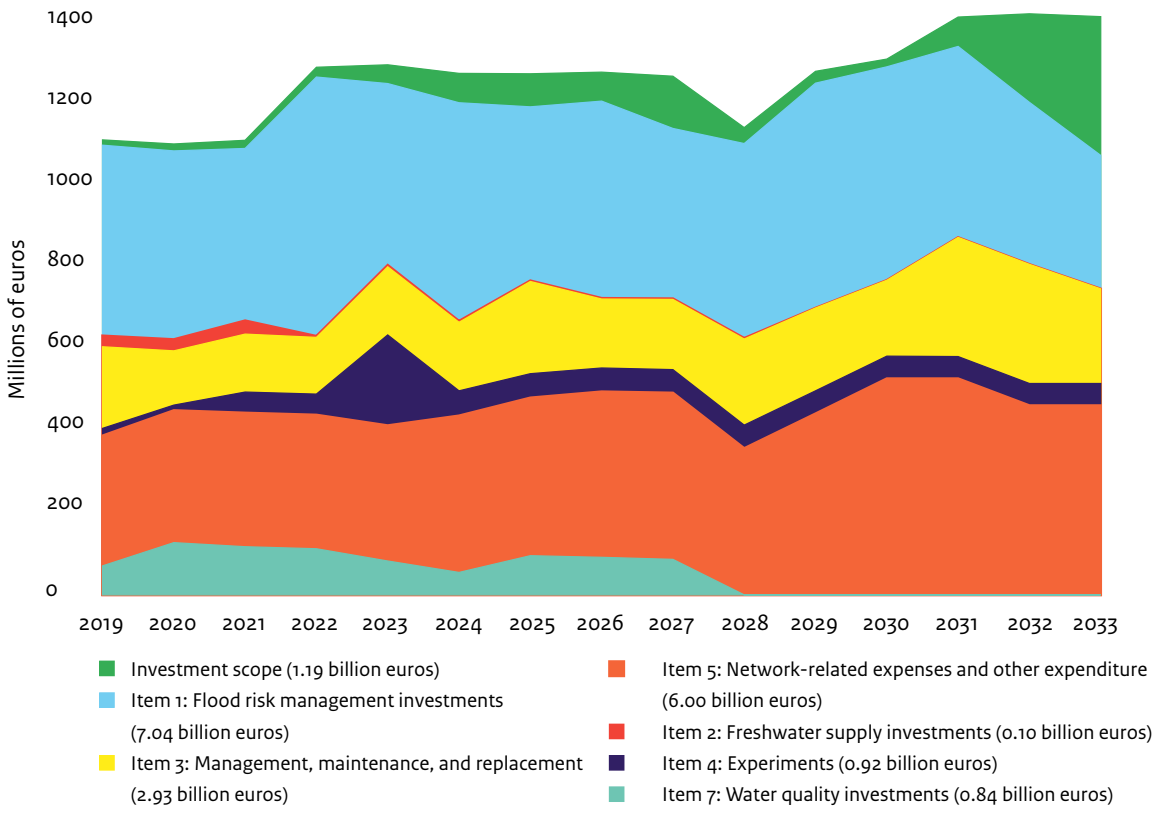


Figure 6 *Delta Fund budgets, per item and totals, based on 2020 draft Budget.*

Non-allocated budget available for investment

In accordance with the structure agreed upon, this budget covers the Delta Fund as extended by another year, i.e., up to and including 2033. After deduction of ongoing commitments (management, maintenance and replacement, Rijkswaterstaat network expenses, and the central government contribution to the Flood Protection Programme), this generates new scope for investment. In 2033, 325 million euros will be available for water-related priority policy taskings.

In the years ahead, these investment funds will be allocated in an adaptive manner, based on ongoing processes such as the assessment of primary flood defences, the Integrated River Management programme, the Delta Plan on Freshwater Supply, and the Delta Strategy regarding Water Quality and Freshwater Supply. In the period 2020-2033, the non-allocated budget available for investment will total 1.2 million euros. This sum includes risk reserves to a total of some 600 million euros.

Reserves

Item 5.04 - "Reserves" - of the Delta Fund covers expenditure for future taskings, for which an Initial Decision is still pending. Currently, the main items budgeted up to and including 2033 and relevant to the Delta Programme are: Regional flood defence systems managed by the central government (198 million euros), Integrated River Management (535 million euros), second round of freshwater supply investments (150 million euros), Major Waters Programme Strategy (543 million euros), research reserves (24 million euros), Spatial Adaptation (7 million euros), and the Statutory Assessment Framework 2035 (20 million euros). Further details regarding these reserves are provided in the Delta Fund budget.

6.2 Resources from other partners

District water boards

Investments

By keeping 3,300 kilometres of primary flood defences up to par, the district water boards are securing protection against flooding from the sea, the IJsselmeer lake, and the major rivers. The other 14,400 kilometres of flood defence systems managed by the district water boards keep water from other waterways at bay. In addition, the district water boards are responsible for the management of watercourses to a total length of 225,000 kilometres. With 6,175 pumping stations, tens of thousands of minor hydraulic structures, and a wide range of planning measures, the district water boards ensure a continuous and sufficient (not too much, not too little) supply of good-quality water. With 325 wastewater purification plants, the district water boards purify the water that the 7.9 million households and 1.7 million businesses in our country discharge into the sewer system. In addition, five district water boards in the western part of our country have the ancillary responsibility of managing 6,600 kilometres of roads and 1,000 kilometres of bicycle paths.

As a result of climate change, the rising sea level, soil subsidence, urbanisation, salinisation, stricter environmental standards, the necessary energy transition, and the closure of (raw material) cycles, this infrastructure calls for substantial investments on the part of the district water boards. The district water boards' investment agendas for the years ahead show that they will collectively be investing an annual average of 1.5 billion euros in the period 2019-2022 (see Figure 7). Figure 8 reflects how this sum is distributed across the tasks.

Flood Protection Programme

Investments in flood defence systems account for the largest share in the overall district water board investment totals (see Figure 8). The bulk of the investments go to the primary flood defences. Up until 2011, the central government had funded the improvement of primary flood defences by the district water boards. With effect from 2011, when the district water boards joined the Flood Protection Programme, such funding has been the shared responsibility of the district water boards and the central government. In the years 2011 up to and including 2013, the district water boards contributed 81 million euros per annum to the Flood Protection Programme. In 2014, this increased to 131 million euros and in 2015, their contribution rose to 181 million euros. Since 2014, investments by the district water boards and the central government have been on a par. With effect from 2016, the sums have been subject to annual indexation; in 2019, the district water boards and the central government will each invest 191 million euros[30].

[30] Sum based on 2018 price level, to be indexed later on in 2019.

Gross investment expenditure 2019-2022

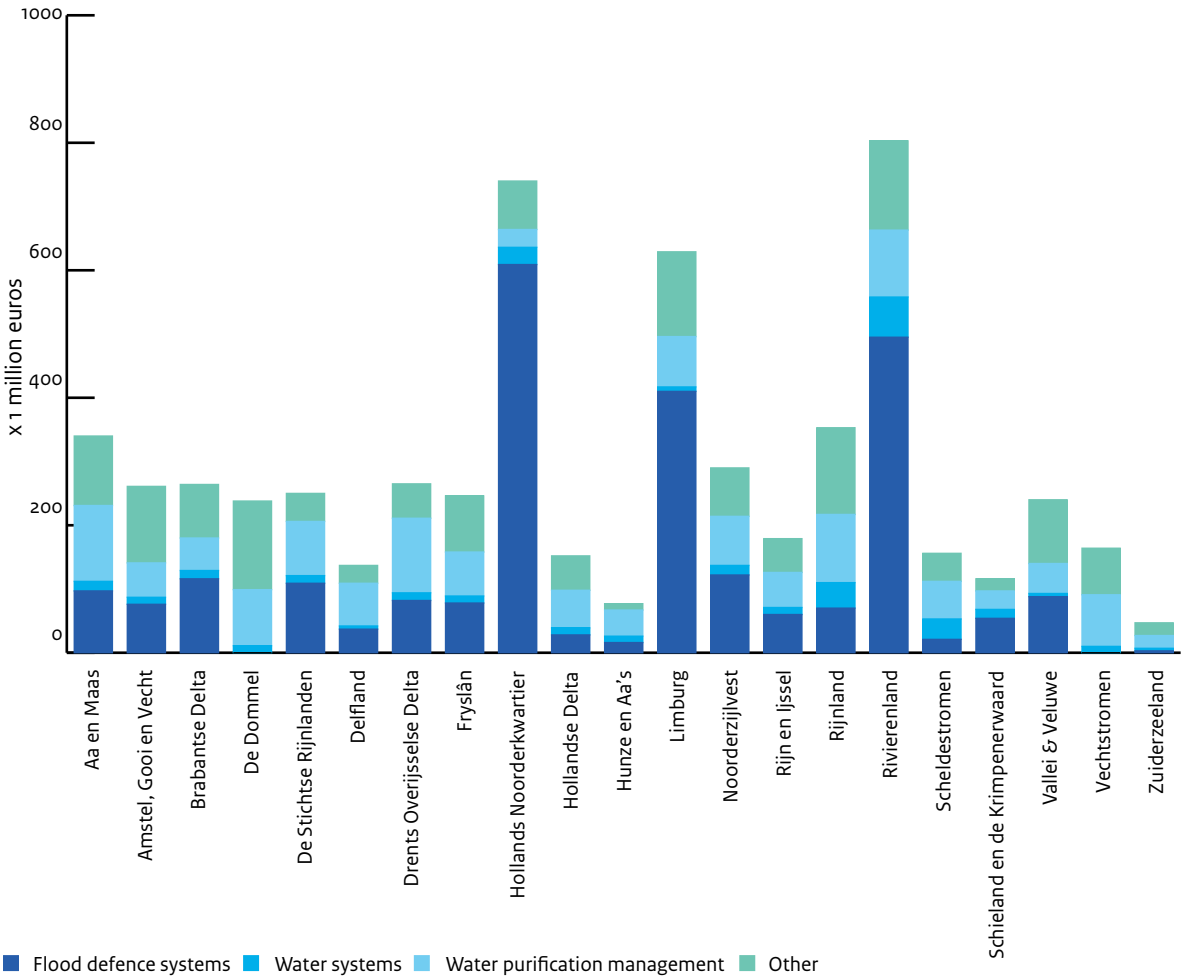


Figure 7 *Total investment expenditure in the period 2019-2022, by district water board and by task*[31].

[31] Source: Association of Dutch Regional Water Authorities, WAVES, ABF Research.

Average investment expenditure

Annual investment expenditure in 2019-2022

- Flood defence systems, 630 million euros
- Water systems, 360 million euros
- Wastewater purification, 400 million euros
- Other, 85 million euros

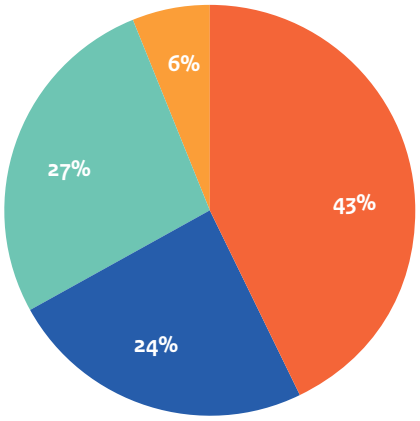


Figure 8 *Average annual investment expenditure by the district water boards in the period 2019-2022, by task*[32].

[32] Source: Land draining rates 2019 – The how and why, Association of Dutch Regional Water Authorities, March 2019.

Provinces

The provinces are contributing to the Delta Programme in various ways: by allocating staff to the various programme teams or within their own organisations, by co-funding sub-programmes, or by contributing to research or the implementation of measures. The provincial efforts are mainly focused on linking the various regional taskings to the Delta Programme taskings. The scope of their efforts – in terms of staffing and funding – differs from one region to the next and is related to the provincial interests in the region concerned. Concrete examples are provided in Chapter 7.

In flood risk management projects, the provinces are investing in linkage opportunities and area developments that enhance the spatial development and the spatial quality of the area concerned. For example, the provinces of Limburg and Noord-Brabant are closely involved in the preparations for dyke improvements and river widening along the river Meuse, in combination with the enhancement of spatial quality. The province of Gelderland is combining flood protection along the river IJssel with area development, in the MIRT Exploration regarding the IJsselpoort River Climate Adaptation Park. The province of Overijssel has conducted, in collaboration with the district water boards, a General Exploration into water system measures in the river Vecht basin. Within the framework of the Houtrib dyke improvement, the province of Flevoland is investing in the construction of a water sports beach near Lelystad. The province of Fryslân is collaborating on the exploration regarding the Koehool-Lauwersmeer dyke section and on the elaboration of the Vlieland dyke improvement plan. In the province of Groningen, the Eemshaven-Delfzijl dyke improvement is being carried out as a multi-functional concept, involving the construction of a Double Dyke. The area between the two dykes will be used for nature development, silt traps, and "saline farming". The province of Noord-Holland is co-funding the Prins Hendrikzanddijk dyke improvement project on the island of Texel, involving a dynamic sandy area to provide additional flood protection and to enhance nature in the Wadden Sea.

The provinces play a coordinating role in the Water Availability process. Several provinces have initiated regional processes in collaboration with district water boards and farmers (Dutch Federation of Agriculture and Horticulture LTO). Furthermore, some provinces have invested in the Spaarwater climate adaptation pilot. At several locations, this pilot has explored ways to improve the freshwater supply to farmlands. Other ongoing programmes are focused on brook restoration measures, water preservation on sandy soils, and the optimisation of water systems. The province of Noord-Brabant has set up a grant scheme for projects aimed at water saving or water retention. Under the Drought Policy Platform, the provinces have contributed to the substantiation of the policy recommendations regarding groundwater.

The provinces are mapping out spatial adaptation taskings on the basis of (regional) stress tests, and are setting down agreements on the measures required through risk dialogues. The outcomes are set down in implementation programmes (see concrete examples in Chapter 5). In the years ahead, the provinces will give additional impetus to climate adaptation efforts and the implementation of measures, as stipulated by the Administrative Agreement on Climate Adaptation.

Municipalities

In 2019, the aggregate municipal revenue earmarked for urban water management totalled 1.646 billion euros. The sewage charges paid by residents and businesses account for nearly 99 per cent of this sum. Approx. one-third of the expenditure goes to the repayment of loans for facilities constructed earlier and the interest on such loans. Slightly less than half is earmarked for the management of the sewerage systems and other wastewater, groundwater, and rainwater provisions.

6.3 The financial taskings and security of the Delta Programme

The Delta Fund constitutes the financial foundation of the Delta Programme. It provides the resources for the future flood protection of our country and for securing a sufficient supply of fresh water. Assuming an annual extrapolation by 1.4 billion euros, the Delta Fund will have some 11.9 billion euros available for the implementation of the Delta Programme in the period 2034-2050.

The tentative extrapolation in Figure 9 is based on the year 2033. In this respect, the Delta Programme Commissioner has assumed that the district water boards will continue the series earmarked for new flood protection measures after 2032, in accordance with the agreements between the central government and the district water boards, as anchored in the Water Act. The extrapolation shows that out of the approx. 1.4 billion euros going around annually in the Delta Fund in the period 2034-2050, an annual sum of approx. 0.7 billion euros will be needed for management, maintenance and replacement (item 3) and network-related and other expenses (item 5). In terms of investment budget, an annual sum of approx. 0.7 billion euros will be available in the period 2034-2050; this involves the budget for the series available / earmarked for new flood protection measures by the district water boards (items 1 and 2) and the reserves relevant to the Delta Programme (item 5). The investment budget available in the period 2034-2050 would thus amount to 11.9 billion euros. This means that, from now on up to and including 2050, a total sum of some 25.3 billion euros would be available for the flood risk management and freshwater supply taskings of national importance. Added to this sum will be the funds that Delta Programme partners other than the central government and the district water boards, such as the provinces, are expected to provide.

For the implementation of the Delta Programme in the period up to and including 2050, Delta Programme 2016 sets out an estimated budget of 26 billion euros, at a bandwidth of +/- 50% (as is realistic for such a long term). This estimate will be reviewed within the context of the six-year review of the Delta Programme. New insights into the scope of the Delta Programme (such as spatial adaptation measures) and into the cost of measures such as dyke improvement and river widening will then be factored in.

For now, the Delta Programme Commissioner has concluded that the taskings and the available resources are reasonably well balanced, considering the tentative extrapolation of the Delta Fund up to and including 2050, and the yet to be reviewed estimate of the overall Delta Programme costs. Currently, the long-term financial security of the Delta Programme is warranted.

Tentative extrapolation of the Delta Fund

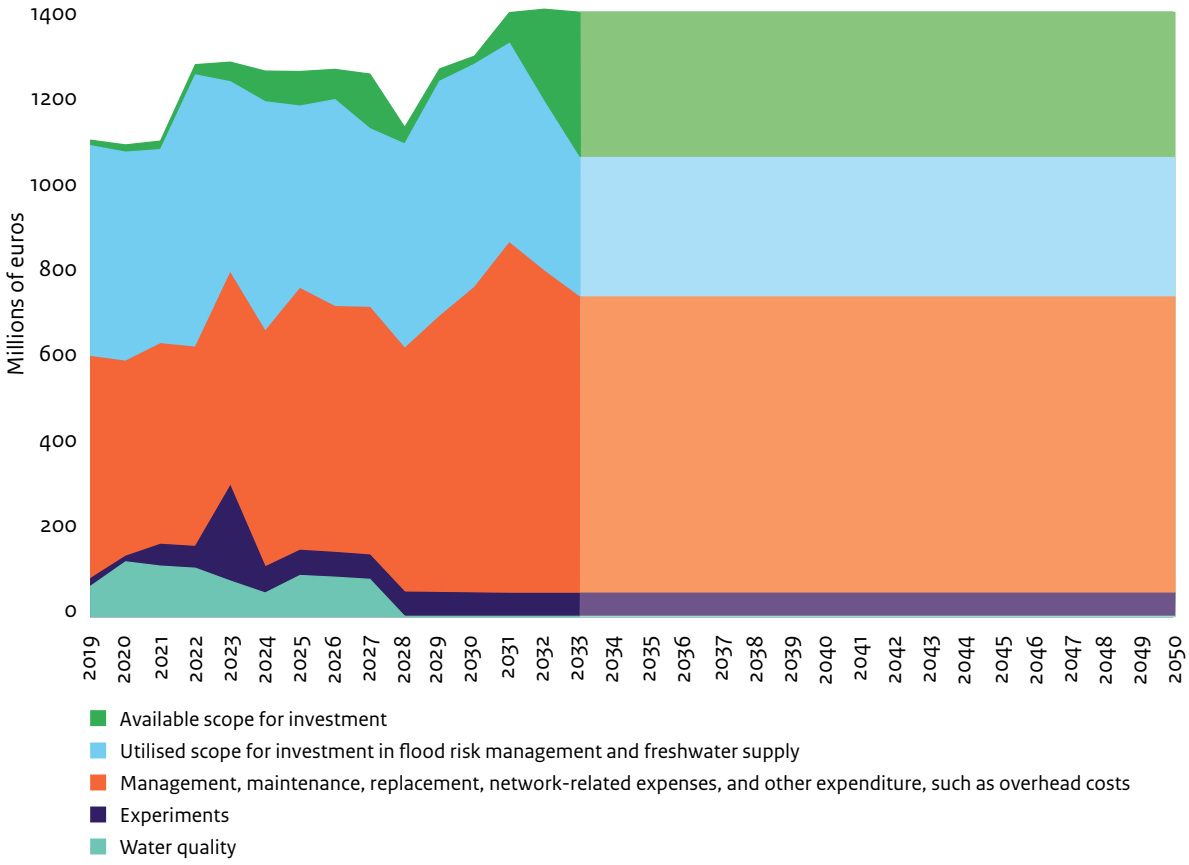


Figure 9 *Tentative extrapolation of the Delta Fund.*

CHAPTER 7

Progress per region

Lob van Gennep, riverbed water storage

This chapter reflects the progress made by each individual region in the implementation of the regional Preferential Strategies for flood risk management, freshwater supply, and spatial adaptation, and sets out how the regions are substantiating the integrated approach and participation process.

7.1 IJsselmeer Region

7.1.1 Progress in implementation of Preferential Strategies

Flood risk management

The Delta Decision[33] for flood risk management of the IJsselmeer Region is aimed at maintaining the average winter water level up to 2050 at its current mark. The Preferential Strategy[34] features sufficient gravity-driven drainage and pumping facilities to drain water to the Wadden Sea and ensures the strength of the dykes. Its implementation is on schedule.

Rijkswaterstaat has commissioned improvement of the IJsselmeer Closure Dam (Afsluitdijk), in order to ensure that this dyke will protect the hinterland from the force of the sea at least until 2050. The work commenced in 2018. The dyke will be improved along its entire length and both lock complexes will be provided with storm surge barriers. Additional sluices will be constructed at the lock complex near Den Oever in order to be able to discharge more water to the Wadden Sea. Occasional high water levels in the Wadden Sea prohibit gravity-driven drainage. That is why two large pumping stations will be constructed near Den Oever. The stations are energy-efficient and fish-friendly. Work on the IJsselmeer Closure Dam will be completed by 2022.

The other dyke improvements in the IJsselmeer Region are also proceeding as scheduled. The Houtrib dyke improvement is in progress. Rijkswaterstaat is having a section of this dyke improved with rubble and another section with wide, sandy shores. The project will be completed by 2020.

The plans for the improvement of the Markermeer dykes were available for public inspection at the end of 2018. Seven appeals have been lodged, which the Council of State is expected to consider by the second half of 2019. Preparatory work has commenced nonetheless. The draft decisions regarding the Marken dyke improvement have also been open to public inspection. The project is expected to be launched in 2022.

In early 2019, the Integrated Study into Flood Risk Management and Water Level Management produced recommendations regarding water management in the IJsselmeer Region beyond 2050. The recommendations are based on the analysis of several strategies for the long-term level management of the main water system (2050-2175) and the associated hydraulic effects, the costs of dyke improvements and water drainage, and an estimate of their impact on the quality of regional water management and nature. In early 2019, the Ministry of Infrastructure and Water Management, the district water boards, the provinces, and Rijkswaterstaat discussed the results and the considerations with respect to policy and the six-year review (see 7.1.2).

Freshwater supply

The summer drought of 2018 has also revealed several bottlenecks in the IJsselmeer Region. The unexpectedly long duration of the drought caused the IJsselmeer to salinise. Substandard surface water quality jeopardised the intake of IJsselmeer water for drinking water purposes near the town of Andijk in the province of Noord-Holland. Monitoring failed to produce an early warning. Furthermore, the capacity of the supply basins at the drinking water facility is only small, whilst the production process is no longer geared to an elevated chloride content in lake IJsselmeer. An important insight was that more efficient collaboration between all the parties is essential to be able to properly tackle the salinisation of lake IJsselmeer and its impact, and also in the purview of operational management during dry periods and the preparations for such periods.

The partners in the IJsselmeer Region freshwater supply region have elaborated their collective ambition in a vision document. The ambition underpins the regional measures scheduled in phase 2 of the Delta Plan on Freshwater Supply. With a view to creating a resilient system, phase 2 will include measures involving the main water system, the regional water system, and the transition from the main system to the regional system. Measures prompted by the

[33] See DP2015, 2.5 Delta Decision on the IJsselmeer Region.

[34] See DP2015, 3.2. IJsselmeer Region.

2018 drought will also be included. The regional Water Availability processes are continuing; the ensuing measures for the regional system will be entering the implementation phase. Users are encouraged to take water-saving measures at the company level. Preparations have commenced for two large-scale projects which also involve farmers: Zoete Toekomst Texel [Fresh Future for Texel] and Zoet op Zout in het Lauwersmeer [Fresh over Saline in lake Lauwersmeer]. In addition, a regional coordinator will be appointed to raise water awareness among consumers and to promote water conservation.

On 14 June 2018, the Minister of Infrastructure and Water Management endorsed the new IJsselmeer Region water level ordinance. The water level ordinance, the environmental impact statement, and the Memorandum of Reply were subsequently open to public inspection. Four appeals were lodged, which the court dismissed. No appeals have been lodged to a higher court and the water level ordinance has thus become final. In 2018, the substantiation of mitigating measures, damage compensation, and the Navigability Regulation commenced. In early 2019, Rijkswaterstaat set down the "Operationalisation of Flexible Water Level Management" protocol. This protocol, which has been formulated in collaboration with district water boards and other stakeholders, comprises operational agreements regarding the regulation of the IJsselmeer and Markermeer water levels. In early 2019, Rijkswaterstaat received funds from various sources (Delta Fund, Framework Directive on Water, Natura 2000) to adapt the Hoeckelings dam to level fluctuations on the basis of the building with nature concept. The Hollands Noorderkwartier district water control board, the province of Noord-Holland, and the Markermeer Dykes Alliance have contributed to the plan. All the measures involved are scheduled to be completed by the end of 2023.

Under the Area Development of De Dulf-Merksen and vicinity, the district water board raised the water level in the Nijbeets sand dredging lake and the nearby Oordt's-Merksen Natura 2000 area in 2018, and set up a measurement network. Its aim is to make the nature reserve and the farmlands in the vicinity less prone to drought, whilst concurrently expanding the drinking water extractions.

Spatial adaptation

With respect to spatial adaptation, two Working Regions are active in the IJsselmeer Region: Flevoland and in the province of Noord-Holland the area north of the Noordzee Canal (Noorderkwartier Water Chain Collaborative). All the municipalities in the two Working Regions must have completed stress tests by the end of 2019.

In Flevoland, the Zuiderzeeland district water board, the six municipalities, the Community Health Service GGD, and Rijkswaterstaat have joined forces in the KAF (Climate Adaptation Flevoland) Working Region. This Working Region is focusing on raising awareness, inter alia, by publishing a KNMI climate brochure and organising a collective meeting for private parties active in the garden sector. Furthermore, experience has been gained with concrete planning measures during a major overhaul of the Regenboogbuurt district in Almere. In Almere Poort, local wadis have been constructed between roads and houses in order to combat waterlogging.

In the Noorderkwartier area, several parties have embarked on climate adaptation. A case in point is the Nieuw Den Helder neighbourhood, part of which is being renovated in a climate-adaptive manner. A project on the island of Texel revolves around the climate-adaptive saline cultivation of potatoes and flower bulbs. The know-how amassed will be shared by the Fresh-Saline Hub for the low-lying parts of the Netherlands. This initiative, launched by the province of Noord-Holland, the Hollands Noorderkwartier district water control board, the municipality of Texel, the Noord-Holland water company (PWN), and Rijkswaterstaat is aimed at the dissemination of knowledge regarding the impact of salinisation.

7.1.2 Potential amendment of Delta Decision and Preferential Strategy

The Delta Decision on the IJsselmeer Region is resilient. This is the preliminary conclusion of the review that commenced in 2018. For the time being, the Preferential Strategies for flood risk management and the freshwater supply up to 2050 are up to par. Until 2050, water will be discharged into the Wadden Sea through a combination of discharge by gravity (if possible) and pumping (if need be). By 2022, the IJsselmeer Closure Dam project will be supplying the required pumping capacity. The new IJsselmeer water level ordinance area constitutes the basis for a structurally available freshwater supply. The results of the Integrated Study into Flood Risk Management and Water Level Management (ISWP) – which focused on the long-term water management of the main water system (beyond 2050) – have been discussed in the IJsselmeer Region Administrative Platform. On 4 April 2019, the Platform decided to examine which recommendations ensuing from the ISWP study can already be accommodated in the ongoing review, and which recommendations can only be considered in the subsequent review or at a later date, because they still involve too many uncertainties or because topics require further research. The impact on the regional system is taken into full consideration in the elaboration of the ISWP recommendations for the main water system.

7.1.3 Integrated approach

Flood risk management projects also see the substantiation of other goals, particularly through capitalisation on linkage opportunities. Cases in point are the improvement of the IJsselmeer Closure Dam, the Houtrib dyke, the Marken dykes, and the Markermeer dykes.

In 2019, the plan elaboration for the integrated approach to the Frisian IJsselmeer shores will commence. The province of Fryslân is elaborating sets of measures for the shores near Workum, Mokkebank, Lemmer/Tacozijl, Hindeloopen, and Gaasterland, in collaboration with the municipalities of Súdwest-Fryslân and De Fryske Marren, Wetterskip Fryslân, It Fryske Gea, the Netherlands Society for the Protection of Birds, and the central government. The measures are aimed at combating erosion of the natural environment outside the dykes, which could be linked to regional taskings in such fields as leisure activities, cultural history, and nature. The central government has set aside 12 million euros from the Delta Fund for erosion-reducing measures; the region and the Society for the Protection of Birds are together investing 4.9 million euros in several sets of measures. The Minister of Infrastructure and Water Management and the regional administrators signed the Administrative Agreement in February 2019 during a field trip to Workum.

Under the auspices of the province of Noord-Holland, several parties are collaborating in the Spatial Quality of the Hoorn-Amsterdam Lakeshore Ambition Programme. The parties identify opportunities and set up projects aimed at combining dyke improvement with nature, leisure activities, tourism, and cultural history. In 2018, the province, the municipality of Waterland, and the district water control board co-funded measures to combine the Marken dyke improvement with the enhancement of spatial quality on the former island.

The Delta Programme shares much ground in common with the "IJsselmeer Region Agenda 2050". That is why, since the summer of 2018, the IJsselmeer Region Administrative Platform has been addressing both Delta Programme topics and regional agenda topics. This fosters an integrated approach. The IJsselmeer Region Agenda 2050 is promoting an integrated approach by linking opportunities and taskings in the area, for example, in the fields of climate adaptation, energy transition, cultural heritage, economic functions, and nature. At the end of 2018, the regional agenda was further elaborated into the Implementation, Knowledge and Innovation Agenda 2019-2020. In addition to regional agenda activities, it also features actions by other administrative platforms, such as those covering the New IJsselmeer Closure Dam, the IJssel-Vecht delta, and Markermeer-IJmeer. In early 2019, the exploration regarding the energy transition in the IJsselmeer Region was completed, which constitutes input for the Regional Energy Strategies of the regional authorities. In 2019, two new topics were added to the Implementation, Knowledge and Innovation Agenda 2019-2020 which are demonstrably related to climate adaptation: salt monitoring in lake IJsselmeer (prompted by the drought of 2018) and integrated area development of the transitional zone between lake Markermeer, the Oostvaardersplassen, and the Lepelaarplassen. Both topics also bear directly on the programmed strategy for the major waters. With respect to leisure activities and tourism, an exploratory study is being conducted under the administrative auspices of the provinces of Noord-Holland and Flevoland.

One of the ambitions of the IJsselmeer Region Agenda 2050 is the development of a future-proof water and eco system. This foundation layer must be up to standard in order to enable sustainable development. In this respect, the regional agenda has adopted the relevant flood risk management and freshwater supply frameworks set out in the Delta Programme. Another ambition is to properly gear intended measures to the qualities and functions of the area, and wherever possible, combine them with nature restoration and nature development measures. At locations requiring dyke measures, the regional agenda will encourage the application of new concepts, such as building with nature, the construction of foreshores, additional water storage provisions in polders, and hindshores, and multifunctional dykes.

7.1.4 Participation

The elaboration of a broadly supported flood risk management solution to the dyke improvement project near Durgerdam (a section of the Markermeer dykes) is scheduled to commence in 2019. This step was preceded by an intensive participation process focused on the integrated tasking, which involved working groups, design workshops, lectures, and public meetings. The municipality of Amsterdam is working alongside the district water control board on the elaboration of the plan for the Durgerdam public space. In the autumn of 2019, the documents pertaining to the elaboration of the dyke improvement variant will be prepared for the further procedure.

The IJsselmeer Region Regional Consultation Committee represents a wide range of NGOs, among which are several nature and leisure organisations, and sector organisations. In recent years, the Consultation Committee has contributed to the preparation of the new IJsselmeer Region water level ordinance. For example, at an early stage, it has provided an overview of bottlenecks in the watersports sector, in order to produce a collective picture of the issues

involved in the introduction of the water level ordinance. Upon the launch of the regional agenda, the Consultation Committee has assumed a more comprehensive role. In addition to providing input in the IJsselmeer Region Delta Programme, the parties represented on the Committee also wish to weigh in and collaborate on the taskings and ambitions of the regional agenda, including those aimed at rendering the IJsselmeer Region (eco) system resilient and future-proof.

7.2 Rhine Estuary-Drechtsteden / West-Netherlands Freshwater Supply Region

7.2.1 Progress in implementation of Preferential Strategies

Flood risk management

The preferential strategy for flood risk management in the Rhine Estuary-Drechtsteden area is based on the existing system of dykes, storm surge barriers, and river widening[35]. Wherever possible, the authorities seek to combine amendments to these preventative measures with regional developments. Disaster control constitutes an integral element of the Preferential Strategy. In addition, the region aims to enhance the safety of areas outside the dykes and of vital and vulnerable objects.

In the period 2023-2028, Rijkswaterstaat will be conducting a follow-up study into the partial closure of the Maeslant storm surge barrier. The follow-up study will be focused on the implementation and its impact on the flood protection of the hinterland.

Rijkswaterstaat and the Schieland en de Krimpenerwaard district water control board are exploring how improvement of the Hollandsche IJssel storm surge barrier will impact the the Hollandsche IJssel flood risk management tasking. In 2018, a system analysis was completed which provides insight into the lowering of normative high water levels. In 2019, the parties will embark on the exploration and elaboration of the opportunities entailed in improvement of the storm surge barrier. The results will be available in early 2020.

The dyke improvements set out in the Flood Protection Programme are on schedule. In 2018, extensive consultations resulted in the Preferential Decision regarding the Krimpenerwaard Powerful IJssel Dykes project. The plan elaboration is underway. Many sections of the dykes near Krimpen aan den IJssel, Ouderkerk aan de IJssel, and Gouderak are densely built over. Consequently, constructions are being devised to improve the dykes, whilst optimum use is made of the forelands in the purview of flood risk management. In 2020, the pre-exploration regarding the Geervliet-Hekelingen section was completed. This dyke protects, inter alia, the Spijkenisse urban area.

On account of the relatively high societal risk, more stringent requirements have been set down for this dyke, under the new standards. In collaboration with the Piping and Macrostability General Explorations, new methods (such as infrared technologies, passive radiometry, and electromagnetic measurements) are being harnessed to map out the characteristics of the dyke and its susceptibility to piping. The goal is to gain more insight into the condition of the dyke, thus opening up the option of cheaper measures.

The Forelands General Exploration was completed in 2019. The Schieland en de Krimpenerwaard and the Rijnland district water control boards have conducted an initial analysis of the Hollandsche IJssel forelands. This revealed that a currently substandard stretch of dyke of some ten kilometres would meet the standards if the positive effect of the forelands in terms of flood protection is factored in. Improvement of the Hollandsche IJssel storm surge barrier is expected to boost the safety level even further.

In 2019, the Rhine Estuary-Drechtsteden Delta Programme launched the “Spatial Planning and Dykes pilots. These are aimed at exploring how, in the long run, the existing legal instruments can provide sufficient scope for future dyke improvements that may be necessitated by the (potentially accelerated) rise in sea level. To this end, several practical examples are being elaborated. The region aims to use the results to fine-tune the action perspectives regarding the spatial planning of the dykes, within the context of the review of the Preferential Strategy.

In Dordrecht, the province, municipality, Security Region, district water board, Rijkswaterstaat, and the Environmental Service are working on the three layers of multi-layer flood risk management within the Living Lab focused on enhancing the Eiland van Dordrecht coping capacity. The parties are exploring, in particular, the embedding of extra safe dykes in statutory standards, the promotion of coping capacities, flood-proof urban developments, and the realisation of shelters.

At several locations in the Alblasserwaard-Vijfheerenlanden area, the A5H Regional Council seeks to link flood risk management to spatial developments. In the first half

[35] See DP2015, 3.4. Rhine Estuary-Drechtsteden.

of 2019, a project developer, the district water board, the municipality, and the province of Zuid-Holland will explore whether a scheduled area development in Alblasserdam (Mercon Kloos location) can be integrated into the future dyke improvement, and what pros and cons this will entail. Upon a positive outcome, the parties intend to enter into a collaborative agreement in order to pursue a more detailed elaboration.

On the basis of national guidelines, the Security Regions in the Rhine Estuary-Drechtsteden area are working out the so-called impact analyses to underpin action perspectives and evacuation strategies. The analyses are scheduled to be completed in 2019. The analyses have shown that several locations in the region do not qualify for vertical evacuation and that certain areas have a need for public shelters. The Zuid-Holland Zuid Security Region, the municipalities of Dordrecht and Rotterdam, and the province of Zuid-Holland are currently working on terms of reference for such shelters (new and existing buildings) which will be applicable nationwide. The impact analyses provide greater insight into which areas are prone to simultaneous flooding. This enables coordination of (horizontal) evacuation strategies.

In concert with stakeholders, the municipality of Rotterdam and the Rotterdam Port Authorities are developing area-based flood risk management strategies for all the areas outside the dykes in the region. The strategies pertaining to the Botlek, Waal-Eemhaven, and Merwe-Vierhavens port areas are ready. The strategy covering Merwe-Vierhavens has been incorporated into the spatial framework for scheduled area developments. A flood protection strategy for the Europoort areas outside the dykes is currently being developed in collaboration with the businesses concerned. The business community and infrastructure managers are participating intensively in these activities through working sessions; they contribute location and process expertise which is essential for the compilation of an effective flood risk management strategy. The analysis of flood risks and the development of a strategy for the populated areas outside the dykes in Rotterdam will commence in 2019. The basic analyses (flood depths for various return frequencies) have been completed. The process calls for specific attention because of the diversity in stakeholders: residents, businesses, and managers of (vital) infrastructure. Similar to the work involving the port areas, an ancillary goal of the collective efforts to develop a concrete area-based strategy is raising awareness of flood risks and of the action perspective.

Freshwater supply

The implementation of freshwater supply measures is largely on track. The lead time of the Capacity Expansion of the Climate-proof Water Supply measure has been extended by two years on account of the Lopikerwaard regional process overrunning its schedule. Other components of this measure have entered the plan elaboration and implementation phases. Variants have been elaborated for the Enkele Wiericke section and for Park Oudegein; historical research has been conducted with respect to the Doorslagluis. In mid-2018, a dispute with the contractor resulted in the suspension of the dredging operations in the Gekanaliseerde Hollandsche IJssel, but following a new tender procedure, the work will be resumed. The Hollandse Delta district water board is working on the implementation of the Bernisse project, which will improve the resilience of a key supply to the region (Hollandse Delta/Delfland/Port of Rotterdam).

On 14 March 2019, the Freshwater Administrative Platform approved the allocation of additional resources to the Bernisse-Brielse Meer water system. Investments in measures such as an additional automated inlet, automated polder inlets, and the development of a Decision Support System will boost the resilience of the water system. Water management can thus be optimised.

The regional parties are collectively preparing the next phase of the Delta Plan on Freshwater Supply. Their aim is to select measures that will help to improve water quality, foster circularity (such as reuse of effluent), prevent soil subsidence, and support spatial adaptation.

During the drought of 2018, the region benefited from efficient collaboration and the measures that had already been implemented, such as Smart Water Management, part of the capacity expansion of the Small-scale Water Supply, and the modification of the Irene locks. Furthermore, the drought has added to the sense of urgency and confirmed the importance of area-based elaboration of the Water Availability instrument.

Spatial adaptation

In the western part of the Netherlands, increasingly more municipalities, district water boards, and provinces are embracing spatial adaptation. At many locations, the dry and hot summer of 2018 caused damage to greenery, roads, and crops. Towards the end of the summer, waterlogging caused additional local damage (e.g., around Boskoop).

All the western Working Regions have conducted virtually regionwide waterlogging, heat, and drought stress tests. Several municipalities have actively worked on flood impact containment (Rotterdam, Dordrecht, Amsterdam), but across the board, this component is being substantiated at a higher scale level (province of Zuid-Holland, Amsterdam metropolitan area, and Utrecht Security Region). The results of the stress tests are featured in Climate Impact Atlases for the province of Zuid-Holland, Rijnland (the Noord-Holland section), and the Amstel, Gooi en Vecht area, and in the

Utrecht South West Climate Stress Test report. In 2019, several Working Regions will be supplementing the stress tests with other topics, or reviewing the outcomes on the basis of the new standards. The province of Utrecht has launched a climate portal to disseminate information on topics such as the stress tests. In 2018, the Utrecht Spatial Adaptation Coalition organised a climate summit at the Royal Netherlands Meteorological Institute KNMI to discuss the results.

Most of the regions have set up risk dialogues in 2019, at the neighbourhood, city or regional level. In Dordrecht, experts, students, policy-makers, and stakeholders from public and private parties have collectively elaborated pilot projects during the Dordtse Lenteschool week. Gouda is taking the lead in the national impact project entitled "Risk dialogue for a climate-proof subsiding historic city".

In the Rotterdam/The Hague Metropolitan Area Working Region, nearly half of the municipalities already have an adaptation strategy and/or a spatial adaptation implementation agenda in place. A case in point is the Rotterdams Weerwoord Urgency Document, which the municipality has drawn up in collaboration with the district water boards. The document sets out how climate adaptation efforts will be intensified, embedded in working processes, and expanded to all the urban districts in the years ahead. In *Weerkrachtig Zuid-Holland*, the province of Zuid-Holland sets out how it intends to climate-proof the province, in concert with its partners. The Utrecht Spatial Adaptation Coalition has initiated a strategy, which will be elaborated in more detail in 2019.

Most of the municipalities in the western part of the Netherlands have already incorporated a waterlogging implementation agenda in their municipal sewerage plans, including its financial coverage. In most cases, financial coverage of other measures is secured through linkage. Municipalities tend to take particular advantage of linkage opportunities in maintenance and new construction activities. Adaptive solutions are used increasingly frequently in the renovation of the public space. For example, the recessed streets, playgrounds, and public parks in Diemen are capable of retaining rainwater during downpours up to an hourly maximum of 120 mm of rain. The western part of the Netherlands will see a great deal of construction activity in the years ahead. The region is responding by finalising the construction frameworks in the Zuid-Holland Climate-adaptive Construction Covenant and the Climate-proof New Developments ambition document of the Amsterdam Metropolitan Area.

In most of the Working Regions, bottlenecks tend to involve capacity and funding rather than knowledge. Throughout the western part of the Netherlands, initiatives are being launched to promote commitment to spatial adaptation among residents and private businesses. Examples of such initiatives are Amstelveen Rainproof, Climate-resilient Delfland, and Climate-prepared in the Utrecht region.

7.2.2 Potential amendment of Delta Decision and Preferential Strategy

The Delta Decision on the Rhine-Meuse Delta has turned out to hold good until 2050. Currently, there is no reason for amending this Delta Decision. The line of approach to be taken in the Delta Decision covering the period beyond 2050 will mainly depend on the potential replacement of the storm surge barriers and the method to be used to this end. Another determining factor is the rate at which the sea level is rising. DP2017 has already indicated that the exploration of methods to replace the Maeslant storm surge barrier is expected to commence around 2040.

The review of the Delta Decision is expected to result in a recommendation to conduct this exploration on the basis of a comprehensive, supra-regional system analysis. This will generate a picture of multiple policy options, including, at any rate, variants involving a closable open barrier and closed barriers. A point of attention is that such a broader scope will add to the uncertainty regarding the future Preferential Strategy for the Rhine Estuary-Drechtsteden area. It is advisable to examine what this entails for the no-regret level of investments that are required in the near future, such as dyke improvement, freshwater supply measures, and investments in areas outside the dykes. The follow-up study into the improvement of the Maeslant storm surge barrier, which Rijkswaterstaat is conducting in consultation with the region, will also map out its impact on the hinterland. This will enable optimisation of the flood risk management tasking in the medium term.

The review also covers the Preferential Strategy for the Rhine Estuary-Drechtsteden area. Potential amendments to this strategy ensue from new insights that have been gained over the past five years in regional projects, a survey of the impact of a potentially accelerating and more extreme rise in sea level on this region, and an analysis of how major societal developments (such as the housing tasking and the energy transition) will impact the Preferential Strategy. In the years ahead, the evacuation strategies will also be finalised in more concrete terms.

7.2.3 Integrated approach

The spatial taskings in the Rhine Estuary-Drechtsteden region call for an integrated approach in combination with taskings entailed in climate change. In the Alblasserwaard-Vijfheerenlanden area, the district water board, the project developer, the municipality, and the province have signed a declaration of intent regarding a study into the possibility of combining a dyke improvement and an area

development at the Mercon Kloos premises. The study will also cover the potential integration of measures to combat extreme precipitation, measures to cope with prolonged periods of drought and heat, and measures to reduce soil subsidence. This calls for close collaboration. Governments, NGOs, and the business community are exchanging relevant knowledge in, e.g., the Living Lab focused on the Eiland van Dordrecht coping capacity, workshops on flood risk management outside the dykes, and the Climate Adaptation City Deal platform. A wide range of stakeholders is participating in these activities in order to collectively link the climate adaptation efforts to other taskings and processes.

In 2019, the province of Zuid-Holland endorsed the Spatial Perspective for Dykes. This document provides guidelines for the landscape quality and utility value of dykes in Zuid-Holland. Input has been provided by district water boards and other regional partners.

The Voorne-Putten Collaborative has examined the synergy between multi-layer flood risk management and the energy transition. The area covered by the study has been expanded from the Geuzenlinie (northern margin) to the entire island of Voorne-Putten. The study report shows whether and how the transition towards sustainable energy can contribute to enhancing the flood protection of an area prone to flooding within a short period of time, and prone to high water levels. The results could be applicable to other flood-prone areas as well. The Utrecht Spatial Adaptation Coalition is working on risk dialogues, an initial impetus to an adaptation strategy, and an implementation programme for the region. The municipalities have embarked on the internal embedding of the efforts. For example, in 2018, the municipality of Nieuwegein drew up a climate vision.

Many freshwater supply measures are also conducive to the realisation of other taskings, such as improving the water quality, combating waterlogging, reducing soil subsidence, enhancing nature values, and regional area developments. For example, the innovative Freshwater Plant project (additional wastewater purification) in the Delfland territory is improving the water quality and fostering circular water consumption, because the effluent is purified to a high degree. Via the water harmonica (an ecological purification system with reedy swamps) this water subsequently flows back into the regional water system rather than into the Nieuwe Waterweg. The parties in the West-Netherlands freshwater supply region are addressing water availability in more comprehensive regional processes. Thus, they also prevent consumers/local stakeholders being contacted separately for each individual tasking.

7.2.4 Participation

In the West-Netherlands freshwater supply region, representatives of the agriculture, nature, and drinking water sector are participating in administrative consultations, as are the Rotterdam Port Authorities. During the drought of 2018, the water managing bodies conferred extensively with water consumers regarding ways to cope with the drought and regarding the efficient use of the available water. Local chapters of the Dutch Federation of Agriculture and Horticulture LTO and individual farmers are involved in most of the regional processes that (also) address water availability. Nature organisations are actively involved in the joint fact-finding process regarding water supply routes to the western part of the Netherlands, and in the feedback group regarding the implementation of the decision on opening the Haringvliet sluices. The drinking water sector is working on improving the resilience of drinking water production; wherever necessary, water managing bodies, knowledge institutes, and other parties are involved in studies into alternative sources for the production of fresh water. In the Utrecht region, residents and businesses have been approached by campaigns such as “Naturally, water-friendly gardens”, and working sessions. In early 2019, the www.klimaatklaar.nl website for residents went online.

In the second half of 2019, Dordrecht will launch a process aimed at raising residents’ awareness of flood risks and of their own action perspectives. Several sessions will be organised to speak with residents. The Zuid-Holland Zuid Security Region will be using the results to draw up an evacuation plan for Eiland van Dordrecht.

In the purview of the review of the Preferential Strategy, the partners collaborating in flood risk management pilots and projects have organised workshops regarding important issues. Thus, they actively pursued collaboration with local and regional governments, and with knowledge institutes. In addition, a broad-based group of stakeholders was invited to participate in a meeting on the key themes of the Preferential Strategy. A comprehensive analysis will be conducted to monitor whether all stakeholders are properly involved.

7.3 Rhine/ Area Around the Major Rivers Freshwater Supply Region

7.3.1 Progress in implementation of Preferential Strategies

Flood risk management

The Preferential Strategy for flood risk management along the river Rhine is focused primarily on flood prevention and consequential damage reduction. The Preferential Strategy is going to be expanded within the framework of Integrated River Management. The taskings are both large and urgent. The essence of the strategy is a powerful interaction of dyke improvement and river widening. With a view to maximising the economic and spatial opportunities, collaboration between the governments involved and regional parties is crucial. The area around the river Rhine will thus be rendered safe, climate-proof, and attractive.

An interactive map of measures provides instant insight into the work being done in the purview of a safe, climate-proof, and attractive Rhine basin.

Dyke improvements

The Flood Protection Programme has scheduled a large number of dyke improvements along the rivers Waal, Nederrijn-Lek, and IJssel. Subsequently, these dykes should meet the safety standards in force with effect from 2017. Currently, explorations are underway for the Waal sections of Gorinchem-Waardenburg, the city of Tiel, Tiel-Waardenburg, Nederbetuwe, and Wolferen-Sprok; the IJssel sections of Zwolle-Olst, Zwolle along the Zwarte Water and Apeldoorns Canal Hattem, and Grutbroek Doetinchem; the Nederrijn-Lek sections of Grebbedijk Wageningen-Rhenen, Rijnkade Arnhem, Lekdijk Amerongen-Wijk bij Duurstede, Lekdijk Nieuwegein, Strong Lek Dykes, and the Urban Dykes section. The Twente Canal Zutphen/Gorssel (IJssel/Twente Canals) project is in progress. In 2019, the preliminary exploration / development of the section strategy for the national border/Westervoort section (Waal/Pannerdens Canal) will commence.

In the Zwolle-Olst Exploration, the governments have explored opportunities for linkage with several ecological and leisure taskings. The linkage opportunities that have been identified as promising will be elaborated in the Plan Elaboration Phase, along with the Preferential Alternative for dyke improvement (to commence in 2020). In addition, a feasibility study is being conducted into an option for dyke relocation that would allow the combination of several taskings relating to water level reduction, nature development, and possibly leisure facilities. In 2018, the district water board and the province of Gelderland mapped out potential linkage opportunities and taskings related to the Sprok-Sterreschans and Sterreschans-Heteren dyke improvement projects. These constitute input for the exploration phase.

With respect to the Grebbe dyke, the governments have been working on several alternatives to the dyke improvement, in collaboration with an active group of residents. Opportunities for additional nature (quality), leisure activities (relocation of the marina), road safety, and the generation of sustainable energy will also be taken into consideration. The Environmental Impact Assessment will be completed by the end of 2019, whereupon the preferential alternative will be set down.

River widening

In 2018, the Environmental Impact Assessment procedure for the IJsselpoort River Climate Adaptation Park commenced. In that same year, the steering group set down the Memorandum regarding Promising Alternatives. This sets out the interventions whose impact is mapped out in the Environmental Impact Assessment report. River widening in the IJsselpoort River Climate Adaptation Park (along the river IJssel) should not impact the discharge distribution between the rivers Nederrijn and IJssel. This means that the area around the Nederrijn river must be capable of equivalent river widening. In 2018, the IJsselkop MIRT Study mapped out the options for river widening along the river Nederrijn. On the basis of this study, the IJsselpoort River Climate Adaptation Park exploration is based on a 10 cm water level reduction at the IJsselkop bifurcation (to be realised through an adaptive implementation programme) and a 20 cm reduction within the IJssel project area. Decisions regarding the further widening of the Nederrijn will be taken within the Integrated River Management (IRM) programme. The draft intermunicipal framework vision regarding the River Climate Adaptation Park is expected to be presented for public inspection by October 2019. The framework vision will comprise, inter alia, the preferential alternative selected, the Environmental Impact Assessment report, and the (adaptive) implementation programme. The final decisions (including the MIRT decision) is anticipated by the spring of 2020.

Collaboration with North Rhine Westphalia

With respect to flood risk management, the central government, the Rijn en IJssel and Rivierenland district water boards, and the province of Gelderland have joined forces with several organisations in North Rhine Westphalia. Their collaboration is focused on the exchange of knowledge, collective research, and policy coordination.

Within this context, the Netherlands and North Rhine Westphalia have conducted collective research, within the Arbeitsgruppe Hochwasser, into flood risks in the border area. This is relevant, because flooding in the German part of the border region may have an impact in the Netherlands and vice versa. The study has mapped out the differences in flood risk management strategies pursued on either side of the border and has identified current and future flood risks. The study was completed in 2019 and the results were presented on 5 July 2019 during the International Flood Conference. The conclusion is that continuation of the cross-border collaboration and further elaboration of some substantive themes would be good and necessary.

Freshwater supply

The freshwater supply measures in the area around the major rivers comprise studies, a climate adaptation pilot, and an incentive scheme for consumers. In 2018, the Water Conservation incentive scheme, which had been in place for the area south of the rivers for some time, was also opened to consumers in the area north of the rivers. The region is mapping out the freshwater supply in the surface water system using models for several subregions. The models for the Land van Heusden en Altena and the Land van Maas en Waal areas are ready; the supply models for Vijfheerenlanden and Alblasserwaard are currently being developed. In 2019, the Rivierenland district water board will launch the "Sustainable use of shallow groundwater" climate adaptation pilot, in collaboration with parties such as the provinces and drinking water companies. This pilot will address the expected climate change and its impact on the water supply, water requirements, water shortages, salinisation, and subsidence of river water levels. The water authorities aim to anticipate such trends by the sustainable utilisation of shallow groundwater. This will enhance the region's coping capacity and reduce its dependency on water inlet from the main water system. In Arnhem, finally, within the context of the replacement of a pumping station, options are being explored for the use of aquathermics, thus combining freshwater supply with the production of thermal energy. The project has entered the planning phase and will subsequently be implemented by the Engie power company.

A few years ago, the International Commission for the Protection of the Rhine set up the Low Discharge expertise group. In 2018, the expertise group reviewed last century's periods of low discharge volumes and found that the current frequency of low Rhine water levels equals that of one hundred years ago. This can be attributed to, among other factors, the re-regulation of reservoirs in Switzerland. This adds to the water supply during dry periods. However, periods of low discharge have an additional impact on several utility functions, for example, the shipping, industry, agriculture, and energy production sectors. A follow-up study into long-term trends will constitute the basis for a decision regarding the development of a collective low discharge management plan or potential measures in the third catchment management plan under the Water Framework Directive. In 2019, the International Commission will embark on low discharge monitoring and intensive communication regarding measures to be implemented during periods of low discharge and drought.

With respect to freshwater supply measures in the eastern part of the Netherlands, see Elevated Sandy Soils-East Freshwater Supply Region.

Spatial adaptation

With respect to the progress of spatial adaptation in the eastern part of the Netherlands, see Elevated Sandy Soils-East, Spatial adaptation.

7.3.2 Potential amendment of the Preferential Strategy

The Preferential Strategy for the Rivers (2014) is mainly underpinned by the flood risk management tasking. It involves a powerful interaction between dyke improvement and river widening. It is important to gain a more concrete picture of the actual scope of essential dyke improvements and of how river widening could reduce the dyke tasking, also because the new standards have added to the tasking. Consideration will be given to the potential impact of river widening on other taskings (such as sediment replenishment, river valley vegetation, and dyke improvements in floodplains to compensate for higher water levels; water retention during periods of drought; and enhancing landscape quality). The Preferential Strategy for the Rhine will be reviewed within the context of the policy choices that are being prepared in the purview of Integrated River Management. The policy choices will be assessed in terms of both the high water and the low water situation, and with respect to all the river functions.

Potential amendments to the Preferential Strategy for the Rhine are:

- formulating goals with respect to riverbed level, the degree of river widening, and the resulting reduction in water level;
- in addition to goals, identifying measures and scheduling the next round.

Preconditions for goal attainment to be included:

- transparent financial framework;
- monitoring the impact on aspects such as the stage line and the riverbed morphology.

Goals and measures will be embedded in policy.

7.3.3 Integrated approach

In 2018, the Boven-IJssel was subjected to an initial analysis. The analysis has provided an overview of the different

(sector-based) taskings relating to the Boven-IJssel and their interrelationship. A sector-based approach entails particular risks at locations where nature taskings coincide with waterway or flood risk management taskings, potentially involving high costs for compensating and mitigating measures. The analysis has shown that integrated planning and elaboration is highly advisable or even essential with respect to three clusters: Havikerpoort up to and including Olburgsewaard, Cortenoever, Bronckhorsterwaarden, and Tichelbeeksewaard. The intention is to further elaborate the strategy for these clusters within the framework of Integrated River Management.

The Area around the major rivers freshwater supply region is pursuing an integrated approach by building on the Spatial Adaptation pilot in the dialogue on the Water Availability issue in the Land van Maas en Waal area. Combating soil subsidence is adding to the freshwater requirements, as a result of underwater drainage. This has not yet been taken into account in the calculation of the total water requirements of the area around the major rivers (70 m^3/s). In the future, this will be factored in.

7.3.4 Participation

The Water Conservation incentive scheme (2016-2017) has been established with input from a representative group of freshwater consumers, speaking on behalf of the Southern Agriculture and Horticulture Organization (ZLTO). In 2018, the northern chapter of the Dutch Federation of Agriculture and Horticulture (LTO-Noord) was involved in a small-scale regional process aimed at developing an incentive scheme geared to the area north of the major rivers.

7.4 River Meuse

7.4.1 Progress in implementation of Preferential Strategies

Flood risk management

The Preferential Strategy for the Meuse aims to render the Meuse safe and attractive through a powerful interaction of dyke improvements, river widening, and area development. The point of departure is the realisation of a sustainably safe river as the basis for an economically prosperous region, while maintaining or enhancing its specific landscape values and nature values. The paragraphs below comment on the short-term and long-term projects, as reflected in Map 4.

Short-term measures

Dyke improvements in existing section

In the province of Limburg, eight dyke improvement projects are being carried out under the Flood Protection Programme. The district water board is actively involving local stakeholders in the potential alternatives. Plan elaborations are underway for the Nieuw Bergen, Belfeld, Beesel, Willem-Alexanderhaven Roermond, Steyl-Maashoek, Buggenum, and Heel projects. The preferential alternative for the Kessel dyke stretch involved removal of the flood defence system (from the Water Act). The Blerick project, near the old foundry, has been completed. In the province of Noord-Brabant, the Aa en Maas district water board embarked on preliminary explorations for the Cuijk-Ravenstein dyke stretch (Brabant side) in 2018. These will generate the scope for the actual exploration: dyke improvement following the existing outlines or expansion of the dyke stretch.

Combination of dyke improvement and river widening

As yet, the 42 dyke sections in the Limburg Meuse Valley need to flow in during normative discharge levels, in order to contribute to the discharge and storage of Meuse water. The new flood risk management policy enables departure from this overtopping requirement, on the condition that floodplain loss will be limited. In 2017, the Minister of Infrastructure and Water Management designated twelve areas[36] in which the current dykes will be relocated or in which retention measures will be implemented. Once these locations are up for dyke improvement under the Flood Risk Management Programme, the options for dyke relocation or maintenance of retention capacities will be explored.

The central government and the region have agreed on explorations regarding six of these areas. With respect to four explorations, the preferential alternative was set down in 2019:

- *Thorn-Wessem*. The aim is to structure the rural area between these two towns in a manner that enables the continuation of farming and leisure activities, whilst at the same time creating water storage capacity during extremely high water;
- *Baarlo-Hout-Blerick*. In addition to dyke improvement, the exploration has also mapped out a dyke relocation for the northern section and an area development. Geohydrological and financial reasons preclude the construction of a secondary channel in the vacant winter bed. The exploration has also demonstrated that the area is anything but empty and sparsely built, This complicates

[36] House of Representatives, session year 2017-2018, 26625, no. 409.

the tasking;
- *Arcen*. For this location, a dyke improvement and a dyke relocation have been explored. Fitting in the dyke relocation turns out to be complex. Consequently, several variants have been elaborated;
- *Well*. The exploration addressed both dyke improvement and dyke relocation. Dyke relocation is supported by regional stakeholders; an old secondary channel can serve as a green river.

The fifth area, *Venlo-Velden*, has been tackled under the More Meuse More Venlo project. The exploration was officially terminated in early 2019; several regional partners have withdrawn from the project. With respect to the dyke tasking and the Venlo-Velden dyke relocation transmission effect measure, the Limburg district water board and the central government need to set down new agreements regarding a Flood Protection Programme / MIRT Exploration. In 2019, the municipality of Venlo will finalise its decisions regarding the development of the barge terminal, the industrial port, and the marina (i.e., the spatial-economic taskings). The exploration concerning the sixth area, *Lob van Gennep*, commenced in the spring of 2019, under the auspices of the Limburg district water board. Lob van Gennep is a natural depression in the landscape, which from time immemorial has flooded during Meuse surges. The area is located on the transition from the Meuse valley to the Dyked River Meuse. The exploration is aimed at three goals: improved flood water storage (lower downstream water level), improved flood protection in the area itself, and enhanced spatial quality with opportunities for leisure activities, tourism, cultural heritage, and the landscape.

In addition to the system restoration measures, three projects involving a combination of dyke improvement and river widening have been rolled out:

- *Southern Meuse Valley (initiated by the municipality of Maastricht)*
  Flood protection is a major challenge for the city of Maastricht. Raising the existing dykes in urban areas by some 1.5 metres is undesirable on account of its impact on the identity of the city and thus on its social and economic appeal. The study focuses on river widening in combination with urban developments to preserve and enhance the identity of the city. The central and regional governments are aiming to set down agreements regarding a potential exploration phase by 2020, to be based on a completed MIRT Study.
- *Meandering Meuse (formerly Ravenstein-Lith, initiated by Aa en Maas district water board)*
  This combined Flood Protection Programme / MIRT Exploration commenced in 2017. The aim is to combine river widening, dyke improvement, and area developments (in the purview of, inter alia, nature, leisure activities, cultural heritage, and commercial shipping) into an integrated plan. In 2019, the provinces of Gelderland and Noord-Brabant will be working on an inter-provincial Framework Vision to embed policy choices regarding the preferential alternatives for the entire area. A final decision on the preferential alternative is envisaged for early 2020, as is the associated administrative agreement.

River widening

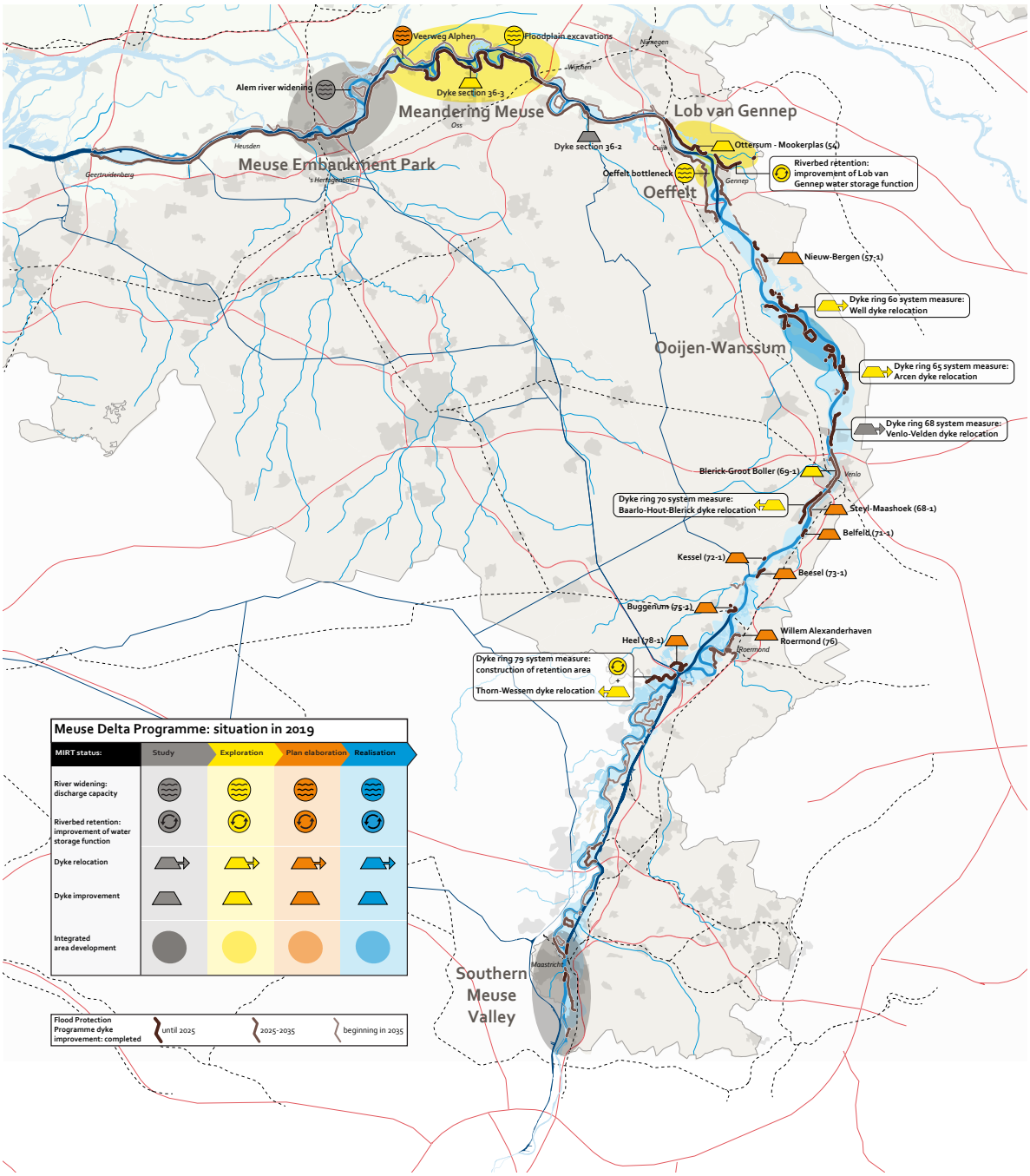
Several river widening projects have been initiated along the Meuse. In the MIRT Consultation Committee meeting of November 2018, the central government and the region set down the following decisions in this regard:

- The Oeffelt bottleneck exploration will enter the plan elaboration phase, subject to specific conditions;
- The Alem study (ensuing from the Meuse Bank Park MIRT Study) will enter the exploration phase, subject to specific conditions;
- The central government and the region will co-fund additional water level reduction in the purview of the short-term realisation of the "Veerweg Alphen bridge extension" project, within the ongoing Across the Meuse project. The contributions will be set down following administrative coordination with the partners in 2019.

Long-term measures

In recent years, the region and the central government have explored potential river widening locations, and assessed the effectiveness, costs, and public support of measures. In 2018, the Meuse Delta Programme Steering Group set down the Meuse Spatial Perspective, which maps out the main spatial and economic taskings along the River Meuse until 2050, with respect to several scale levels (international, national, and regional) and several purposes (nature, shipping, leisure activities, tourism, et cetera). The Meuse Spatial Perspectives provides insight into the potential incorporation of flood protection measures.

On the basis of this information, the Delta Meuse Steering Group compiled a set of measures pertaining to river widening and dyke improvement along the entire Meuse in the summer of 2019: the Meuse Adaptive Implementation Strategy. This strategy comprises several sets of potential river widening measures based on the knowledge amassed over recent years. The potential measures are aimed at reducing the height requirements for dyke improvements, and at enhancing natural values, landscape values, and economic functions. The sets of measures contained in the Meuse Adaptive Implementation Strategy constitute key building blocks for the elaboration of the policy decisions and for the substantiation of the flood risk management measures to be scheduled under the Integrated River Management programme. programme. The strategy covers issues such as the elaboration of river widening measures in the purview of flood risk management (reduction of height



Map 4 *State of affairs, Meuse Delta Programme projects.*

requirements) and river widening by way of compensation for, e.g., improvement of floodplain dykes, sediment replenishment to stabilise river bed situations, and the impacting effect of nature on floodplains.

In the spring of 2019, river experts formulated the Story of the River Meuse. This report deals with the development of the River Meuse, the disrupted balance, the taskings, and the challenges. It constitutes expert advice to all the parties working on the management and planning of the Meuse: the experts provide recommendations and guiding principles for policy, management, and planning. The report thus contributes to the societal discussion regarding the course to be taken in the planning of the Meuse. It alerts, agendises, and helps to make choices regarding, Integrated River Management. The Story of the Meuse is a substantive report and does not have any policy-related, legal, or financial significance.

Freshwater supply

With respect to the implementation of the Preferential Strategy regarding freshwater supply in the area around the major rivers: see Area Around the Major Rivers Freshwater Supply Region and Elevated Sandy Soils-South Freshwater Supply Region.

Spatial adaptation

For the progress made in spatial adaptation: see Elevated Sandy Soils-South.

7.4.2 Potential amendment of the Preferential Strategy

The Preferential Strategy for the Rivers (2014) is mainly underpinned by the flood risk management tasking. It involves a powerful interaction between dyke improvement and river widening. It is important to gain a more concrete picture of the actual scope of essential dyke improvements and of how river widening could reduce the dyke tasking, also because the new standards have added to the tasking. Consideration will be given to the potential impact of river widening on other taskings (such as sediment replenishment, river valley vegetation, and dyke improvements in floodplains to compensate for higher water levels; water retention during periods of drought; and enhancing landscape quality). The Preferential Strategy for the Meuse will be reviewed within the context of the policy choices that are being prepared in the purview of Integrated River Management. The policy choices will be assessed in terms of both the high water and the low water situation, and with respect to all the river functions.

Potential amendments to the Preferential Strategy for the Meuse are:

- formulating goals with respect to riverbed level, the degree of river widening, and the resulting reduction in water level;
- adding "preservation of riverbed area" to the goal for the Limburg section of the Meuse, in accordance with the policy memorandum to the House of Representatives;in addition to goals, identifying measures and scheduling the next round;
- in addition to goals, identifying measures and scheduling the next round.

Preconditions for goal attainment to be included:

- transparent financial framework;
- monitoring the impact on aspects such as the stage line and the riverbed morphology.

Goals and measures will be embedded in policy.

7.4.3 Integrated approach

In the Regional Proposal for the Meuse 2016, the central government and regional partners in the Meuse region have agreed to take account of ambitions and goals relating to other policy fields, wherever possible, and to pursue an integrated approach. Studies and explorations are consistently identifying linkage opportunities; the aim is to develop integrated, widely supported regional projects. Integrality is achieved both at the overall programme level and in individual projects. At the programme level, this is organised by the Meuse Delta Programme team; regional processes play a key part in this regard. Decisions are taken by the Steering Group. At the project level, responsibility has been vested with the project manager concerned. Regional experience has taught that also at the programme level, it is important for the parties collectively to look for interconnectivity and dependencies (content, timing, financial) between the various taskings and measures. The Lob van Gennep project integrates taskings in the fields of water storage, dyke improvement, and boosting spatial-economic functions.

An integrated approach calls for extensive coordination, in terms of both content and administration. The explorations have shown that in some cases, such coordination fails. For example, the integrated More Meuse More Venlo project was unfortunately terminated. A successful integrated approach, such as in the Ooijen-Wanssum project (in progress) and the Meandering Meuse project (exploration phase), produces significant added value.

River widening turns out to foster an integrated approach. This measure is not only relevant in reducing the dyke improvement tasking, but also serves other purposes. For example, river widening boosts the resilience of the river system and reduces high water peaks. Furthermore, river widening contributes to water retention and opens up opportunities for nature development and compensatory measures. Also, river widening covers the entire width of the river valley, which yields starting points for attaining multiple goals at the same time.

The perspective is a safe and attractive Meuse (in terms of ecology, the economy, and leisure activities). That is why the regional parties regard spatial quality as a key criterion for future measures, in addition to the long-term manageability of the river.

7.4.4 Participation

At the overall Meuse level, a feedback group has been active for many years. This feedback group is made up of representatives of NGOs promoting the interests of sectors such as agriculture, horticulture, mineral extraction, nature, shipping, leisure, and drinking water supply. The feedback group agendises issues for the Meuse Delta Programme Steering Group and the Meuse Valley and Dyked Meuse regional processes. The Chair of the feedback group sits on the Meuse Delta Programme Steering Group and ensures

that the input provided by the feedback group is embedded in decisions.

NGOs are also represented on several project steering groups. For example, the Natuurmonumenten nature organisation is involved in the Meandering Meuse project in its capacity of co-investor. Local governments, stakeholders, and residents are closely involved in all the projects. Depending on the nature and scope of the project, stakeholders can obtain information through information evenings, mailshots, flyers, and a website. In addition, workshops enable them to actively weigh in.

In the Meandering Meuse project, the parties involved and the stakeholders are exploring promising alternatives through an innovative process: design through research. In monthly workshops, the parties are developing building blocks for river widening, dyke improvement, and area developments (nature, leisure activities, and, e.g., access to the port of Oss for commercial vessels). Another case in point is the Oeffelt bottleneck project: efficient collaboration has resulted in the development of a plan to improve the discharge capacity of the Maasheggen area – which was recently designated as a UNESCO Biosphere – and to enhance nature and landscape values.

Meuse Projects 2020 and a biography of the Meuse
Over the past twenty years, the Meuse Projects have generated a wide range of new data on the use of the Meuse between Mook and Eijsden and the immediate vicinity through the ages. Archaeological, historical-geographical, and historical research, and research into the geomorphology has produced many reports and new maps. This data is particularly useful for governments, sand dredgers, and gravel miners. In 2020, a public awareness booklet and an exposition in the Limburg Museum will make the new information available to the public at large. In addition, a group of scientists is working on the biography of the Meuse, in collaboration with the museum, governments, and local and regional experts.

7.5 Southwest Delta

7.5.1 Progress in implementation of Preferential Strategies

Flood risk management

The Preferential Strategy for the Southwest Delta[37] is aimed at a climate-proof, safe, ecologically resilient, and economically vital delta.

The Scheldestromen district water board has conducted an exploration for the Hansweert dyke improvement (extending over 5.15 km); the project has now entered the plan study phase. The district water board is seeking maximum involvement of stakeholders and local residents in the preparations for and implementation of the project.

The final sand replenishments scheduled under the 2016-2019 beach nourishment programme will be carried out in 2019. The deposits near Domburg and the Westkapelse Zeedijk will be completed by the summer. The replenishment near Renesse is scheduled to commence in the autumn of 2019. In February 2019, the Administrative Jurisdiction Department of the Council of State dismissed the appeals lodged against the Roggenplaat sand replenishment. The project will be rolled out in the winter of 2019/2020, whereupon a monitoring programme will be launched. The 2020-2023 beach nourishment programme was endorsed in the summer of 2019. Four replenishment projects are scheduled for 2020-2021: near Ouddorp on the island of Goeree, in the Westkop area of the Schouwen peninsula, and in the Westkapelle-Zoutelande and Dishoek-Vlissingen coastal sections of the Walcheren peninsula.

Within the Flemish-Dutch Scheldt Commission (VNSC), the Flemish Region and the Netherlands are working on an Agenda for the Future. In 2018, the assessment regarding the condition of the Scheldt estuary in the period 2009-2015 was completed (T2015). One of the conclusions was that high water levels in the Dutch section are keeping pace with the rise in sea level. The first VNSC Agenda for the Future research programme was also rounded off at the end of 2018. Among other things, its results underscore the importance of an integrated sediment strategy, at the overall estuary level – including the mouth and coastal areas – to the development of a climate-proof, safe, ecologically resilient, and economically vital Scheldt estuary. The VNSC is making an effort to create room for field tests, in addition to desk

[37] See DP2015, 3.5 Southwest Delta.

Coastal protection near Zoutelande, Southwest Delta, July 2018

and model research. In 2019, the VNSC will set down a roadmap for the follow-up to the Agenda for the Future, in collaboration with the Scheldt Council[38].

The study into the Effects of Sea Level Rise and Oosterschelde Sand Deficit, which commenced in 2018, is exploring how the rising sea level and the erosion of shoals, mudflats, and salt marshes caused by sand deficit is impacting safety, the environment, the economy, and the landscape. In 2019, Rijkswaterstaat will be organising a stakeholders meeting.

In April 2019, the Zeeland Security Region completed the impact analyses for several parts of the region. These will serve as the basis for the formulation of action perspectives, which will be completed by 2020.

Freshwater supply

The freshwater supply measures set out in the first phase of the Delta Plan on Freshwater Supply for the Southwest Delta are closely related to a decision on the salinity of the Volkerak-Zoommeer lake. As such a decision is still pending, the implementation of the freshwater supply measures has incurred some delay. In 2018, the region formulated an alternative set of freshwater supply measures which could be implemented in the period 2019-2021. The Freshwater Administrative Platform has granted its approval. Phase 2 of the Delta Plan on Freshwater Supply will be substantiated in interconnection with the review of the Preferential Strategy for the freshwater supply.

The region has set up a testing ground to gain greater insight into the options for efficient supply management. The freshwater supply tasking mainly involves area-wide coverage, something that has become urgent following the periods of drought in 2018 and the spring of 2019.

In the autumn of 2018, it became clear that the Roode Vaart project in Zevenbergen will entail higher costs. The Freshwater Administrative Platform has endorsed the additional expense under the alternative set of measures. Water transfer to West-Brabant via the Roode Vaart is now scheduled to be operational by the end of 2020. The parties involved have confirmed as much in a collaborative agreement.

In 2018, four new projects were launched within the context of the Freshwater Testing Ground. The Drainstore project (2018-2020) involves the collection of drain water to be injected into the deeper subsoil, in order to create a summer water supply. The DeltaDrip pilot generates information on subsoil dripping irrigations using enriched local groundwater. The More Fruit with Less Water project features several pilot studies aimed at raising the moisture retention capacity of fruit orchard soil. In the Waterhouderij Walcheren project, farmers have joined forces with the district water board to experiment with flexible polder water levels in order to optimise their options for anticipating periods of drought and (expected) large volumes of precipitation. The latter three projects have been awarded EU grants (POP3 grants).

In the International Scheldt Commission, the Hydrology working group has been addressing low water level issues since 2016. The countries represented on the working group share national strategies for the prevention of water shortages. Subsequently, they will draw up a strategy for low discharge management in the Scheldt catchment area, which will be accommodated in the third international catchment area management plan for the Water Framework Directive. In 2017, several regions and countries set down agreements on low discharge notifications. Freshwater supply is one of the issues featuring on the Agenda for the Future drawn up by the Flemish-Dutch Scheldt Commission. One of the aspects being considered is the importance of fresh water to the river ecology.

Spatial adaptation

In 2019, all the governments in the province of Zeeland endorsed the Zeeland Climate Adaptation Strategy Action Plan. This sets out agreements on the substantiation of the seven ambitions featuring in the Delta Plan on Spatial Adaptation, including a schedule and the formulation of climate adaptation strategies at the provincial and local levels. The build-up to the action plan has raised awareness regarding the collective tasking. By the end of 2019, all the municipalities in Zeeland will have conducted integrated stress tests covering the entire province. At the provincial level, an integrated risk dialogue will have been conducted in preparation for the provincial climate adaptation strategy. In addition, some 30 per cent of the municipalities will have conducted risk dialogues.
The Goeree-Overflakkee Working Region conducted an integrated stress test covering the entire island in 2018, and is engaged in a risk dialogue with several stakeholders aimed at developing a climate adaptation strategy.

In many projects underway in the province of Zeeland, climate adaptation is a key factor. The Claverveld residential area in the municipality of Vlissingen has been constructed in a climate-adaptive manner. The IVN Natuureducatie organisation, the Zeeland Area Health Authority GGD, and the Zeeland University of Applied Sciences have initiated the Zeeland Schoolyards Green Revolution, which is co-funded by the province of Zeeland. This campaign is aimed at

[38] The Scheldt Council has been set up by the Flemish Region and the Dutch governments. It advises on the management of and policy regarding the Scheldt estuary. It is composed of delegates from various bodies such as the Scheldt ports, regional and local governments, employers, agricultural associations, and nature organisations.

greening schoolyards, thus contributing to a climate-proof society. Furthermore, the province of Zeeland has set up a Green Rooftops grant scheme.

In Zeeland, several regional dykes, most of which are former sea walls, are located on the land ("dry flood defences"). These dykes play a key role in the event of a flood: they contain the flood to a smaller area, can help to slow down flood water, and serve as an escape route. In the Regional Flood Defences Standards project, the Scheldestromen district water board and the province of Zeeland are exploring how such dykes can contribute to multi-layer flood risk management if the primary flood defences should fail. In early 2019, the provincial authorities have set down a draft safety standard for all dry regional flood defences. In the next phase, this standard will be optimised in collaboration with the stakeholders and the Security Region.

7.5.2 Potential amendment of Delta Decision and Preferential Strategy

If the rise in sea level remains limited to a maximum of 1 metre by 2100, the current Preferential Strategy can largely be preserved. However, Deltares studies have shown that some efforts need intensification, in particular, sand replenishment, minor interventions, and research development.

A 1 to 2 metre rise in sea level by 2100 dictates amendment of the strategy in several respects. In this event, depending on the pace at which the sea level rises, larger interventions could be required between 2050 and 2100, for which choices need to be made well before 2050. In order to gain a better picture of the thresholds and deadlines for making such choices, exploratory studies must be prepared, focused on safety, nature, and economic use. Solution strategies and choices will pertain to, inter alia, water level management; water and bed levels in closed-off basins rising apace with the sea; the use of pumps; the closure regimen of the Oosterschelde storm surge barrier; eventually, choosing between an open or closed Oosterschelde; and dyke improvement methods. The solutions and choices may differ from one Southwest Delta water system to the next: Bergsche Maas, Haringvliet, Hollandsch Diep, Grevelingen, Volkerak-Zoommeer, Binnenschelde, Markiezaatsmeer, Oosterschelde, Veerse Meer, and Westerschelde.

Being in a position to implement effective measures for the Southwest Delta in a timely and interconnected manner is essential. This calls for an integrated exploration of the long-term alternatives, focusing on safety, the freshwater supply, nature, and the economy. In the six years ahead, research will also need to be conducted into potential intervention points and effects in the event that the current Preferential Strategy continues to be pursued.

In addition, the seven ambitions of the Delta Plan on Spatial Adaptation will be accommodated in the Preferential Strategy for the Southwest Delta.

7.5.3 Integrated approach

The strategy for the Southwest Delta revolves around an integrated approach: the strategy is focused on safety, ecology, and the economy.

The Preferential Strategy for the Southwest Delta encompasses the restoration of limited tidal dynamics in lake Grevelingen. This requires a sluice in the Brouwersdam, possibly to be combined with sustainable energy generation through a tidal plant. An exploration into this option is underway. In early 2019, the central government, the provinces of Zeeland and Zuid-Holland, two municipalities, and Staatsbosbeheer set down agreements regarding the completion of this phase. In the period ahead, further research will be conducted into ways of factoring in the rise in sea level as caused by climate change, and into measures required to meet the Natura 2000 regulations.

The research into the sluice variants – with and without a tidal plant – will be completed by the end of this year. The parties have consulted private sector parties regarding their interest in a tidal plant. These consultations have demonstrated sufficient interest in the construction and operation of a sluice in combination with a tidal plant. The parties will involve stakeholders in the studies and plans. In the autumn of 2019, the Minister of Infrastructure and Water Management and the Minister of Agriculture, Nature and Food Quality will decide, on the basis of the outcomes of the exploration, whether the plan elaboration can commence.

The central and regional governments are drawing up a regional agenda for the Southwest Delta, striving for maximum interconnection between the targets and taskings in the fields of flood risk management, freshwater supply, spatial adaptation (Delta Programme), water quality, nature (Major Waters Programme Strategy), and the economy. Furthermore, they seek to expand to and link up with issues such as the circular economy, energy transition, and climate adaptation. The ultimate result is an integrated long-term perspective for the development of the Southwest Delta, including a knowledge and innovation programme, and an exploratory implementation agenda. The project has incurred a delay of one year and commenced in the spring of 2019. A process involving a range of stakeholders is scheduled for 2019; to this end, three workshops will be organised. The aim is to present the Southwest Delta regional agenda in December 2019.

An example of a project involving an integrated approach is the Nieuwdorp Climate Adaptation Street. This

project focuses on both climate adaptation and the energy transition in order to climate-proof the village of Nieuwdorp. The risk dialogue is a key element in the project.

Wherever possible, freshwater supply measures for the agriculture sector contribute to spatial quality, water quality, ecology, nature, and the prevention of waterlogging. In addition, such measures seek to link up with the circular economy, spatial adaptation, and the energy transition. A case in point is the pilot study being conducted by the Scheldestromen district water board, Dow, and EVIDES into the use of wetlands for the (mild) desalinisation of brackish wastewater flows in the vicinity of Terneuzen. The Zeeland Flood Defences Consultative Body has decided on sand replenishment at the Kop van Schouwen, in the autumn of 2019, in order to ensure sufficient protection of drinking water production facilities during a design-level storm.

The Zeeuws-Vlaanderen Resilient Water System project focuses on a sustainable and climate-proof water system that optimally supports the regional functions, whilst enhancing the vitality of the area. The participating parties are Dow, the municipality of Terneuzen, the Southern Agriculture and Horticulture Organization (ZLTO), Staatsbosbeheer, HZ University of Applied Sciences, the province of Zeeland, the Scheldestromen district water board, and Rijkswaterstaat. The parties have initiated this project to share knowledge and experience, and intend to collaborate as equal partners. Linkage opportunities for projects or taskings are reviewed by reference to maps. Furthermore, the parties are collectively exploring opportunities for EU funding and collaboration with Flanders.

7.5.4 Participation

In the Southwest Delta, participation is effected through the Advisory Group, consisting of delegates from municipalities; NGOs in the fields of nature, leisure activities, fisheries and agriculture; and entrepreneurs providing solicited and unsolicited advice to the Southwest Delta Regional Consultative Body. The overall Southwest Delta community is kept up to date through the annual working conference, the www.zwdelta.nl website, newsletters, and Twitter.

The onzedelta.nl website went online in April 2019. The website is intended to inspire the Southwest Delta community to explore opportunities relating to, e.g., the circular economy, the energy transition, and climate adaptation, and to join forces to make the most of such opportunities. The website features inspiring accounts from stakeholders in the Southwest Delta.

The pilot projects initiated within the context of the Freshwater Supply Testing Ground involve close collaboration between entrepreneurs, experts, and government bodies. The concrete results of these tests have boosted commitment among farmers. In 2019, the province of Zeeland and the Scheldestromen district water board will initiate a Community of Practice to which the trendsetters in the agriculture sector will be invited. The aim is to intensify the exchange of knowledge with this group, and actively pursue expansion of the group.

The alternative substantiation of the freshwater supply programme has been effected in consultation with the Southwest Delta Advisory Group. The alternative set of measures is supported by the parties involved in the advisory group.

Within the context of the collective climate adaptation strategy in Zeeland, a comprehensive risk dialogue will be conducted in 2019. The parties to this dialogue include provincial interest groups.

7.6 The Coast

7.6.1 Progress in implementation of Preferential Strategies

Flood risk management

The Preferential Strategy for the Coast is aimed at a safe, appealing, and economically viable coast by connecting the flood risk management tasking with spatial ambitions. The integrated tasking set out in the National Coastal Vision will remain the point of departure. The parties involved are jointly working on a zoning plan to regulate construction in the coastal zone, as set down in the Coastal Pact. The Coastal Genesis 2.0 research programme is substantiating the Decision on Sand, which is focused on keeping the sand budget along the Dutch coast up to par by means of sand replenishment.

The implementation of the Preferential Strategy for the Coast and the Decision on Sand is proceeding as planned.

On 18 October 2018, the Coastal Genesis 2.0 programme team discussed the interim results of the long-term research programme with more than a hundred professionals from

businesses, knowledge institutes, and the government. Collaboration within the research programme is bearing fruit. The past period has seen a range of morphological and ecological measurements, the launch of the Ameland Tidal Inlet Replenishment pilot, and efforts to summarise the findings. The model results turn out largely to tie in with the data obtained. This inspires confidence in the feasibility of the ultimate goal: improved predictability of future developments. The results of Coastal Genesis 2.0 also help to achieve the goals of the National Water and Climate Knowledge and Innovation Programme (NKWK). The Coast focus area of this programme is aimed at keeping the coast safe, now and in the future, in a sustainable manner.

The Ameland Inlet replenishment pilot is in full swing. It is aimed at replenishing sand in a (dynamic) tidal inlet, without having the sand deposited immediately flushed away. The deposits totalling 5 million cubic metres of sand were completed in February 2019 and the deposited sand has stayed in place. A monitoring process will provide insight into sand transport near the replenishment pilot location and into its impact on benthic life. The pilot will generate important information on the behaviour of a tidal inlet and on the interaction between the North Sea and the Wadden Sea, and thus on long-term sand requirements. This should provide a picture of the sustainable ways to have the Dutch coast keep pace with the rising sea level. The results will also be used for a study into similar issues in the Southwest Delta tidal inlets.

In mid-2018, the provinces presented a zoning plan for their coastal areas to regulate new recreational construction. The zoning plans will foster the envisaged character of the various coastal areas, featuring natural dynamics in combination with extensive or intensive leisure activities. In 2019, the provinces will embed the zoning plans in their provincial regulations. The Coastal Pact has thus been substantiated. The zoning plans will provide a significant contribution to the realisation of the Preferential Strategy for the Coast: rendering the coast safe, attractive, and economically viable. In its regulations, the province of Fryslân may include other rules regarding construction on the coastal foundations of the Wadden islands (outside urban areas).

7.6.2 Potential amendment of Decision on Sand and Preferential Strategy

Annual coastal measurements provide a picture of the coastal sand budget. Should the signs regarding a potentially accelerated rise in sea level dictate an amendment of the Delta Scenarios, the annual requirements in terms of sand replenishment will change. In 2020, this issue will be addressed in the policy recommendations to be presented by Coastal Genesis 2.0.

Currently, coastal flood risk management is up to par; there is no reason to interconnect flood protection with spatial taskings. For the time being, the Coastal Pearls and the Linked Growth Concept will, therefore, only be substantiated on the basis of spatial development taskings. A point for attention is the manner in which governments are addressing spatial developments that may affect long-term flood protection. For example, the municipality of The Hague is working on the development of the Scheveningen port. Currently, flood risk management is not an issue at this location. The municipality and the district water control board are exploring ways to secure long-term flood protection by elaborating options and continued growth concepts.

The North Sea is subject to a range of spatial claims for purposes such as sand extraction, wind parks, fishing grounds, and nature parks. This limits the opportunities for sand extraction in the purview of the coastal replenishments required to safeguard flood protection. Consequently, it would seem wise to, on the one hand, to further elaborate the Preferential Strategy for the Coast and the Decision on Sand, based on a comprehensive analysis of sand extraction opportunities, and on the other, to analyse the admissibility of various functional uses of the North Sea. The guiding principle in this could be the perception of the coast serving as a climate buffer. The IPCC and KNMI data on an (accelerated) rise in sea level must be taken into consideration in this respect.

7.6.3 Integrated approach

Regional parties can submit wishes regarding beach replenishment during the annual consultations on the Coastline Care programme. Such consultations are held in the period between March and July. Responses pertain to issues such as the timeframe for coastal replenishment, adaptation of scheduled coastal replenishments, and third-party proposals for new coastal replenishments.

Coastal Pearls are locations featuring potential for development and governance power for the realisation of ambitions. The goal is an integrated approach. The municipality of The Hague is currently realising plans for the revitalisation of the coastal zone north of the Kurhaus hotel. The renovation, encompassing new shops, new catering establishments, and a new parking garage, is in progress. The project will be completed by the end of 2019.

The development of most Coastal Pearls is still lagging behind. This can be attributed to the fact that their flood protection is up to par, which means that there is no scope for tying in with spatial issues. As yet, the ambitions in the fields of habitation and leisure activities appear insufficiently robust for achieving the intended comprehensive development.

7.6.4 Participation

The regional processes along the coast boast broad-based commitment. In collaboration with the coastal municipalities, the district water boards, Rijkswaterstaat, and interest groups, the provinces have set down zoning plans for the coastal areas. In concert with the municipalities along the North Sea coast, nature and environmental organisations, tourism interest organisations, the Southern Agriculture and Horticulture Organization (ZLTO, Rijkswaterstaat, and the district water board, the province of Zeeland has formulated a provincial Coastal Vision. The coastal municipalities are now working on the focus areas that have been identified. The Zuid-Holland Provincial Council has conducted a social debate with residents regarding the future of the coastal area. This social debate has generated input for the draft Strategic Agenda for the Coast of the province of Zuid-Holland. The Agenda has been drawn up in consultation with the Provincial Consultative Body for the Coast. The most relevant parties are represented on this body: governments, area managers, nature organisations, ANWB, and representatives of the catering sector.

The elaboration of the national Noord-Holland Coastal Pact has been completed, involving concerted efforts by 27 partners, under the auspices of the province of Noord-Holland. All the parties are satisfied with the results achieved. The balance between the protection of nature and landscape values and the development of leisure facilities has been secured through beach zoning plans, the existing dune protections, and agreements on further collaboration regarding the dune borders.

The Coastal Genesis 2.0 research programme involves collaboration between doctoral students of the universities of Delft, Utrecht, and Twente (SEAWAD); researchers of the Deltares knowledge institute; Rijkswaterstaat; the Government Shipping Company; the Ministry of Infrastructure and Water Management; local governments; and provinces. In addition, know-how is exchanged with the National Water and Climate Knowledge and Innovation Programme, the Delta Programme, and the ShoreScape[39], PROCOAST[40], and Interreg Building with Nature[41] research programmes.

The venue for the 2018 National Coast Day was a new addition to the Netherlands: seaward of the former Hondsbossche and Pettemer Sea Walls. The key theme was the rise in sea level, which could potentially proceed at a faster pace than has been assumed up until now. The Delta Programme Commissioner emphasised the importance of research into coastal behaviour under a rising sea level. He also made a case for flexible measures that leave options open for accommodating future uncertainties. Other speakers advocated a coastal lab to enable managers and researchers to field-test appropriate methods.

[39] Development of dune landscapes to provide more efficient coastal protection.

[40] Coastal research off the Petten coast.

[41] A European Knowledge Programme in which the Netherlands is collaborating with countries such as Norway, Germany, Sweden, Belgium, Denmark, and Scotland.

7.7 Wadden Region / Freshwater Supply Region North

7.7.1 Progress in implementation of Preferential Strategies

The Preferential Strategy[42]for the Wadden Region focuses on the preservation of the buffering function of the islands, outer deltas, and intertidal areas. Sand replenishment and dynamic dune management ensure a sustainable balance between the sand system of the island coast and the rising sea level. Wherever possible, dyke improvements foster nature and sustainable forms of human use. Each of the Wadden Islands has its own comprehensive flood risk management strategy.

Flood risk management

Regular coastal maintenance, involving sand replenishment and relevant monitoring processes, is proceeding as planned. The channel margin replenishment and the beach replenishment projects on the island of Vlieland have been completed, as has the Ameland Inlet replenishment pilot. Beach replenishment on the western boundary of the island of Ameland is underway. The dyke improvements being implemented under the Flood Protection Programme are well on schedule.

The Wadden Sea Dykes General Exploration will be completed by the end of 2019. New, multi-functional dyke improvement concepts have been field-tested in pilot projects; the results will be presented during the final conference on 9 and 10 October 2019. Several concepts are already being put into practice in dyke improvement projects along the Wadden coast, such as the Eemshaven-Delfzijl section. The Marconi beach and the Double Dyke have been constructed; the years ahead will see their further development. Wind turbines will be placed in the core zone of the Oostpolder dyke. The district water boards are

[42] See DP2015, 3.7 Wadden Region.

exploring concepts to be implemented in several ongoing improvement projects, such as Koehoal-Lauwersmeer, Lauwersmeer dyke, and Den Oever-Den Helder. The Prins Hendrik Sand Dyke on the island of Texel will be completed by the summer of 2019; the overall Texel dyke improvement project is scheduled for completion by the end of 2019.[43]

The Channel Management pilot, which was conducted within the context of the Wadden Sea Dykes General Exploration, has explored whether channel margin replenishment would prevent potential shifting of the Vierhuizergat channel (the channel is currently stable). Following intensive consultations with parties such as the district water boards, Rijkswaterstaat, and the province, the Wadden Sea Dykes General Exploration Steering Group has decided against launching the pilot, mainly because of the high degree of uncertainty regarding the lifespan of the measure and its potentially adverse impact on the ecology.

The Coastal Genesis 2.0 research programme generates knowledge regarding future coastal management (cf. under The Coast). With respect to the Wadden Region, such knowledge development is relevant to the safety of the Wadden Islands and the preservation of the intertidal area. This requires specific information on the operation of the tidal inlets between the islands, as this is closely intertwined with coastal development on the "heads and tails" of the islands, and with sand transport to and from the Wadden Sea. To be able to make the right and timely choices, it is important to know how the inlets and tidal basins will respond to an accelerated rise in sea level (cf. Ameland Inlet Replenishment pilot).

The impact analysis conducted by the Fryslân Security Region, also on behalf of the Groningen and Noord-Holland North Security Regions, is as good as completed, as are the strategic action perspectives for the response to (imminent) flooding and waterlogging. The tactical and operational elaboration is underway, involving, e.g., the formulation of specific action perspectives for residents and arrangements for risk containment. The elaboration and implementation of the measures is coordinated by the Fryslân Security Region Flood and Evacuation Working Group.

Freshwater supply

The provinces of Fryslân and Groningen and the northern part of Drenthe constitute the Freshwater Supply Region North. The Regional Consultation Committee North is the administrative contact with respect to the implementation of the Delta Plan on Freshwater Supply in the northern part of the Netherlands. On account of its links with the Noord-Holland/Flevoland Freshwater Supply Region – and the fact that the two areas used to form a single freshwater supply region – the Freshwater Supply Region North is engaged in administrative collaboration with the latter region. Lake IJsselmeer accounts for a large proportion of its freshwater supply. See IJsselmeer Region / Noord-Holland/Flevoland Freshwater Supply Region for more information on the progress made.

Spatial adaptation

The stress tests are being conducted as planned: by the end of 2019, all the municipalities covered by the Regional Consultation Committee North will have completed their stress tests. In the Fryslân Working Region, the stress tests had already been completed in 2018. Following the stress tests, masterclasses were organised in the six sub-regions to discuss the outcomes in the presence of the district water board, municipal staff responsible for various fields, and the Chair of the municipal Water Executive. Several risk dialogues have been conducted, many of which by way of a pilot study supervised by the Climate Adaptation Advisory Team, as was the case in, e.g., the municipalities of Ooststellingwerf, Opsterland, Weststellingwerf, and Terschelling. Six internal risk dialogues have been conducted in the municipality of Súdwest Fryslân; risk dialogues with its residents are scheduled for the autumn of 2019. In the North-East Agenda Network, administrators have discussed the stress test and the Climate Impact Atlas. In order to raise awareness, climate change and the Frisian Climate Impact Atlas feature on the agendas of several regular consultative bodies.

On the island of Terschelling, the municipality of Terschelling, Wetterskip Fryslân district water board, Fryslân Security Region, the province of Fryslân, Rijkswaterstaat, and the Wadden Island Collaborative have conducted the Terschelling Safe, Climate-proof, and Able to Cope pilot, aimed at integrating the Safe, Climate-proof, and Able to Cope tracks. The process and outcomes of the pilot serve as an example for other Wadden Islands and (clusters of) mainland municipalities.

All the remaining stress tests in the Groningen/Noord-Drenthe Working Region will be completed by the second half of 2019, whereupon the region will embark on the risk dialogues. On account of other administrative priorities (such as municipal rearrangements and earthquake issues), this region has lagged slightly behind the other parts of the Netherlands in commencing its municipal stress tests. Its current approach shows a great spirit of cooperation. For example, the Noorderzijlvest district water board is conducting stress tests for all the municipalities in its territory, in concert with the municipalities. The district water board is taking care of the technical work, which makes it easier for the municipalities to participate. The municipalities are contributing information on the built-up areas, the district water board is putting forward its

[43] See www.hhnk.nl/waddenzeedijk/prins-hendrikzanddijk_41688/.

expertise regarding water system management. In addition to the four national issues (waterlogging, drought, heat, impact of urban flooding), the stress tests also address other regional issues such as earthquakes, soil subsidence, and cyber security, and their impact on vital infrastructure and water management.

The municipality of Groningen has mapped out its vulnerabilities and launched a website reflecting the results. Spatial adaptation has been incorporated into several municipal projects. For example, several locations in the city have been provided with water-permeable pavement. In the Groningen City Park, the surface water storage capacity has been expanded to enable collection of rainwater from the nearby residential area. Furthermore, the city of Groningen has taken measures aimed at prolonged water retention in order to prevent summer dehydration. All the measures have been combined with a circulation system to enhance water quality. In Delfzijl, the town hall has been provided with a green rooftop.

Governments, organisations, businesses, educational establishments, and knowledge institutes have joined forces in the North Netherlands Climate Initiative to tackle climate adaptation. For example, a Climate Testing Ground has been set up on the university campus in the city of Groningen, aimed at gathering, bundling, and developing knowledge; expanding the climate adaptation network; providing information; and raising awareness. In addition, the collaboration is focused on presenting an image of the North Netherlands as a climate adaptation region, through communication, events, and cultural projects. Another goal is marketing climate adaptation expertise at the national and international levels.

7.7.2 Potential amendment of the Preferential Strategy

The potential acceleration in the rise in sea level may affect the Preferential Strategy. As yet, amendment is not being considered.

The dykes could be improved or raised even further. According to a recent study[44], the key question is when and how fast the sea level will start to rise. One of the determining factors is the way in which the climate is developing. In the decades ahead, the Wadden Sea[45] can continue to keep pace with the rising sea level and soil subsidence, because sufficient sand is being supplied from the North Sea coastal zone. However, there is a risk that with effect from 2030, part of the Wadden Sea (the Vlie tidal basin) can no longer keep up to the full extent. This does not mean that the Wadden Sea will be "drowning", yet the erosion and sedimentation processes will be changing. More clarity regarding the rising sea level will be gained in the years ahead, once the IPCC and KNMI findings become available, and new knowledge and insights have consolidated.

7.7.3 Integrated approach

Sand replenishment and dynamic dune management also foster leisure facilities, nature, and the economy. The Ameland Inlet Replenishment pilot, which was launched in March 2018, is intended to develop knowledge regarding morphology, the feasibility of replenishments, and their impact on the ecology. Coastal Genesis 2.0 is mapping out the interrelation between the future sand replenishment strategy and coastal functions.

The innovative dyke concepts generated by the Wadden Sea Dykes General Exploration also foster an integrated approach: these dyke concepts serve multiple purposes. A case in point is the Wide Green Dyke demonstration project[46] that was initiated in 2018 in the area governed by the Hunze en Aa's district water board. The Klutenplas pond in the mud flats in front of the dyke was excavated for two reasons: to extract sludge from the highly turbid Eems-Dollard, and to create a habitat for the avocet. This phase has generated lessons on dyke improvements in a Natura 2000 area. Phase 2 (2018-2021) involves the construction of clay depots enabling the extracted mud to mature to clay to be used for the dyke improvement. The Eemshaven-Delfzijl dyke improvement project encompasses three pilots revolving around multi-functional concepts of the Wadden Sea Dykes General Exploration: Double Dyke, Rich Dyke, and Overtopping Dyke. In addition, projects are being initiated to boost nature, leisure facilities, and the regional economy. This dyke improvement, including the linkage projects, will be completed by the end of 2019. The pilots are also generating lessons on the collaboration between the parties in the region.

[44] In 2018, the Dutch Journal of Geosciences featured an article on "Sea-level rise, subsidence and morphodynamics in the Dutch Wadden Sea; 2030, 2050, 2100".

[45] The capacity of the Wadden Sea to keep pace with the rising sea level is dependent on, inter alia, the sand supply in the North Sea coastal zone (including the outer deltas). As the tide comes in, the flats fill with water flowing in through the tidal inlets. The mud flats connecting to such a tidal inlet are termed a "tidal basin". The international Wadden Sea comprises 39 tidal basins, 10 of which are located in the Netherlands. These areas play an important part in erosion and sedimentation processes.

[46] See DP2019, p 106, box Wide Green Dyke and Clay Maturation Plant.

The sandy improvement of the Prins Hendrik Sand Dyke on the island of Texel has also generated lessons on dyke improvement in a Natura 2000 area. Here, a sandy area has been created featuring dunes and salt marshes, where safety goes hand in hand with nature and the preservation of farmland.

Building on the experience gained in the Wadden Sea Dykes General Exploration, the district water boards are exploring, in collaboration with Rijkswaterstaat and nature organisations, how ecological improvements can be linked to regular dyke improvement.

By mid-2020, governments and private sector parties aim to sign a declaration of intent regarding the formulation of a Wadden 2050 Regional Agenda, featuring a broadly supported policy vision, taskings, and strategies. Climate-proofing the Wadden Region will be one of the key taskings. The regional agenda will also address the question of how Delta Programme taskings can be combined with other taskings in the Wadden Region.

7.7.4 Participation

In the Wadden Region, participation is particularly featured in dyke improvement projects. Stakeholders are involved in all the Wadden Sea Dykes General Exploration pilots. For example, the Fryslân district water board has joined forces with other government authorities and organisations in the nature, agriculture, and leisure sectors in the Dyke with Foreland pilot. The parties are exploring how district water boards can develop, in collaboration with these stakeholders, a collective perspective on foreland management and maintenance in a pilot area.

The Wide Green Dyke pilot, initiated by the Hunze en Aa's district water board, involves close collaboration with a wide range of stakeholders, among which are regional governments; nature organisations such as Groninger Landschap and Natuur- en Milieufederatie Groningen; Ecoshape Building with Nature; Groningen Seaports; land owners; and salt marsh experts. A key topic is working in a Natura 2000 area. The question is how a dyke design and clay extraction or "clay maturation" methods can create a "nature plus".

7.8 Elevated Sandy Soils

7.8.1 Progress in implementation of Preferential Strategies

Freshwater supply

Water supply from the main water system is virtually impossible at the Elevated Sandy Soils. The sandy soils predominantly rely on groundwater. On the one hand, the Preferential Strategy is focused on rainwater retention, storage, and infiltration; on the other hand, on the economic use of water.

Drought of 2018

The prolonged drought of 2018 has caused large-scale drought damage to flora, fauna, and crops at the Elevated Sandy Soils. It has also necessitated measures such as crop irrigation and intensification of inspections, which entailed additional expense. On top of that, more brooks than usual have run dry, whilst higher water temperatures have caused quality issues (blue-green algae, botulism). The drinking water supply in the southern and eastern parts of the Netherlands was not jeopardised. However, in the summer of 2018, the Vitens water company pumped up more groundwater than the volumes for which it had been licensed.

The regional crisis organisations quickly came into operation and emergency measures were implemented, such as transferring fish, and feeding brooks with groundwater. Water preservation measures have borne fruit. Several nature reserves even experienced less drought vis-à-vis other dry years, as a result of measures for achieving the desired groundwater and surface water regime.

Compared to other locations in the Netherlands, the negative effects of more extreme weather appear to have had a more severe impact on the Elevated Sandy Soils. The summer of 2018 featured extreme heat, with temperatures in July nearly 4 degrees higher than normal (the northern part of the country was 2 to 3 degrees warmer than usual). It also caused extreme precipitation shortages and rapidly falling groundwater levels (see Figure 10). The summer of 2018 ranks among the top 5 per cent of the driest years[47]. On account of the limited winter precipitation volumes, the drought of 2018 is still making itself felt in 2019.

The Elevated Sandy Soils South and East intend to learn from the 2018 drought to advance their pursuit of climate-resilient spatial planning and sustainable water consumption. Several studies have been initiated that will shed light on the financial and social impact and provide clarity regarding action perspectives. It will probably take another year or more for the (irreparable) damage to wet terrestrial nature to become manifest.

[47] State of affairs in June 2019.

The Elevated Sandy Soils parties will set to work with the recommendations of the Drought Policy Platform and continue their strategy of maximum water preservation. This calls for a climate-resilient groundwater and surface water system, i.e., a system featuring a balance between groundwater supplementation for the supply of fresh water and water drainage to prevent waterlogging. A climate-resilient system also entails the accommodation of climate changes in the allocation of functions, the adaptation of crop choices, and the implementation of parcel-level measures by land-owners. This requires a comprehensive, area-specific approach, coordination with spatial adaptation efforts, and collaboration with stakeholders. Furthermore, additional measures may be required in areas such as the Centrale Slenk in Noord-Brabant and Limburg, in order to preserve the groundwater supply. Research is being conducted to work out whether the water supply via the Noordervaart needs to be expanded to 6.1 m^3/s.

Freshwater supply measures

Most of the freshwater supply measures involving the Elevated Sandy Soils East and South are being implemented within the context of partner programmes, and also serve purposes other than the supply of fresh water. Many projects are in progress or have already been completed. Their implementation calls for collaboration between regional and local governments, the business community, and NGOs. A total of more than 300 projects and clusters of projects have been rolled out in the southern and eastern parts. The regions are now surveying and calculating the water gains / water savings produced by these projects. Furthermore, they are substantiating the regional knowledge agenda (including the Lumbricus research programme) and converting the changes in the KNMI scenarios and national bottleneck analysis on a regional scale.

In the southern section of the Elevated Sandy Soils, 20 per cent of the total working programme budget is used for the Newcomers Scheme. Newcomers are understood to mean parties that are not associated with the Administrative Agreement on the freshwater supply. In 2018, the full budget reserve earmarked for newcomers was allocated by the provinces. The scheme turned out to garner such interest that ten municipal projects fell by the wayside on account of a lack of budget.

The scheme encourages stakeholders to take on a (pro) active role. This has resulted in collective initiatives by both governments and stakeholders. Examples of such projects are the restructuring of the Geleen stream valley, the realisation of a food forest in St. Michielsgestel, the reuse of rinse water from beer breweries by farmers, and the construction of level-driven drainage. The projects are fostering goals such as an economic use of water and the climate resilience of the region. Another concrete result is

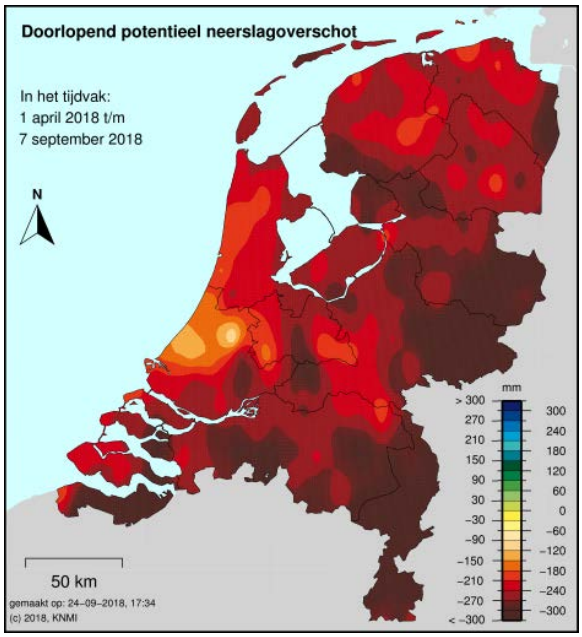


Figure 10 *Precipitation shortages during 2018 growing season.*

the Delta Plan on Water Conservation of the Brabant Water drinking water company. This plan sets out agreements between the province of Noord-Brabant and Brabant Water; it is focused on reducing the growth in (drinking) water requirements and on limiting the use of drinking water for low-grade purposes.

The working programme for the eastern section is also on track. The progress made in 2018 has once more confirmed that the parties involved are more than meeting their regional tender commitments. Several measures and Delta Fund resources have been transferred to other parties (within the signatories to the Administrative Agreement on Freshwater Supply, among whom terrain-managing organisations). For example, the Natuurmonumenten nature organisation is implementing fewer measures than foreseen in 2015, whilst Landschap Overijssel, on the other hand, has scheduled many more. Several partners in the eastern and southern sections are implementing more freshwater supply measures than pledged in the regional tender. In a letter to the House of Representatives, the Minister of Infrastructure and Water Management has indicated that she has made available, in consultation with the Freshwater Administrative Platform partners, a sum of 7 million euros from the Delta Fund (within the resources allocated under the Delta Plan on Freshwater Supply) to tackle, inter alia, urgent projects at the Elevated Sandy Soils.

Spatial adaptation at the Elevated Sandy Soils East

Especially after last year's drought, water availability is a hot topic in the Elevated Sandy Soils East area. Consequently, the relevant risk dialogues are being conducted in close collaboration with the Delta Plan on Freshwater Supply for

the East-Netherlands. Due to differences in altitude, many locations in the Elevated Sandy Soils East area are vulnerable to torrential rain. Several municipalities are addressing this issue in their risk dialogues. Linkage with spatial developments or projects in the spatial domain will offer opportunities to deal with such vulnerable locations.

Several municipalities expect to draft or be able to set down adaptation strategies by the summer of 2019. The province of Overijssel has drawn up a Regional Adaptation Plan. The Elevated Sandy Soils East area has set up the Climate Campus, a network comprising educational establishments, residents, research institutes, entrepreneurs, and government bodies. Its aim is to render the IJssel-Vecht delta/Zwolle region resilient against climate change, and to capitalise on climate adaptation as an opportunity.

Spatial adaptation - Regional Consultation Committee for the Meuse/Elevated Sandy Soils

In all the Working Regions, stress tests are available. Several locations are subjected to more in-depth tests, in order to gain a better picture of their vulnerability to the four climate issues. The two provinces are also conducting stress tests, focusing on issues such as infrastructure vulnerability. Climate maps are being prepared (Hart van Brabant region) or available (Mergelland and the Meierij / North-east Brabant region). The maps constitute the basis for initiating a risk dialogue. Furthermore, the climate maps can be used to coordinate regional plans with the regional energy strategy, on the road towards Environmental Visions and environmental plans.

The preparations for risk dialogues are in progress, in many cases, at the regional level. Not all the preparatory work has been completed though. An example of such preparation is the Zitterd Climateproof area development, in which a brook restoration plan for the city of Sittard is being supplemented with climate adaptation, heritage and cultural history, regional wastewater plans, and bicycle access to the historic city centre. The development process involves an interconnection of multiple parties and purposes. The implementation of the first phase commenced in 2019.

In anticipation of the regional substantiation of policy embedding scheduled for 2020, the South Netherlands Regional Consultative Body has embarked on the formulation of a draft adaptation strategy. Furthermore, a process has been initiated to develop the South Netherlands Climate Adaptation Implementation Programme (UPZN 1.0) into a 2.0 version by 2020.

7.8.2 Potential amendment of the Decision and Preferential Strategy

Currently, there is no reason for adjustment of the strategy or the measures.

7.8.3 Integrated approach

An integrated freshwater supply strategy is the standard approach at the Elevated Sandy Soils. Efforts are being combined with a range of (ground) water quality and quantity goals, the design of a resilient water system, several climate change aspects, and other interests of consumers. Cases in point are the Marswetering in the Drents Overijsselse Delta district water board area, and the Apeldoorn brook plan, involving collaboration between the Vallei en Veluwe district water board and the municipality of Apeldoorn on the restoration and reuse of fourteen urban brooks. This approach also ties in with the Delta strategy regarding water quality and freshwater supply.

The freshwater supply regions South and East are seeking to link up with the municipal stress tests being conducted in the purview of spatial adaptation, thus working on integrated solutions for urban areas. The municipality of Zutphen and the Rijn en IJssel district water board have drawn up a collective climate programme: “Zutphen, a pleasant climate”. Under this programme, the district water board and the municipality will be joining forces with local stakeholders to work on concrete solutions and gain experience with climate adaptation.

Blue Gate, Laarbeek Water Farm

The Blue Gate along the N279 motorway is a water storage facility and a “water farm”. The Blue Gate serves as a freshwater supply buffer during dry periods, and can also be used for water storage provision during wet periods. The combination of a range of regional taskings – nature, expansion of a business park, water management, cultural history, and leisure facilities – has created a new landscape icon, as a gateway to the Peel area.

Zundert climate-resilient brook landscape

In 2018, the municipality of Zundert, the province of Noord-Brabant, the Brabantse Delta district water board, and the village councils of Achtmaal, Wernhout, and Klein Zundert signed a collaborative agreement to boost the vitality of the rural area. In 2019, they will be continuing to work on climate-proofing the Zundert rural area. They have adopted an integrated approach to tackle farmland vacancy, population ageing, climate change, and the transition to sustainable energy and agriculture. They are setting to work in three ways:

- encouraging the community to join forces, for example, addressing vacant farm buildings;
- drawing up a collective new perspective of the rural area in the purview of future policy, such as the Environmental Vision and the water management programme;
- adopting a learning approach to discover how new forms of collaboration can be established, between residents, entrepreneurs, organisations, and governments.

Streams and Heritage training and manual

Starting in 2019, the Cultural Heritage Agency of the Netherlands will be organising training courses on stream valleys and integrated water management, in collaboration with the Foundation for Applied Water Research STOWA and the Heritage Academy. Water storage, nature restoration, and combating dehydration are important spatial taskings on which the district water boards have been working for quite some time. A proper, comprehensive analysis constitutes an important first step in the exploration of solutions to these taskings. This involves the assembly of data on soil, subsoil, water, ecology, landscape genesis, and human use. The training courses use the instruments and methods set out in the Dutch Streams and Heritage manual[48] to develop a so-called "landscape biography". The emerging landscape knowledge and qualities can be used as a developmental force in brook restoration projects. An understanding of the past changes in landscape and water, brought about by natural conditions and/or by human intervention, generates a clear picture of the close interrelation between the soil, the deeper subsoil, and the water system. Such understanding, when combined with a participatory approach and a bundling of (water) taskings incumbent upon the various partners and stakeholders, can ultimately yield great profit, enhance commitment among new partners, and garner support among local stakeholders.

[48] The manual is a concerted effort by STOWA and the Cultural Heritage Agency.

7.8.4 Participation

Collaboration with consumers was one of the key topics addressed during the start-up meetings for the East and South regions. During the start-up meetings, the delegates looked ahead to the implementation phase, whilst private parties and organisations participated in a knowledge market, presenting ideas such as green-blue schoolyards, level-driven drainage, and alternative crops for farmers. The dialogue with landowners and other stakeholders will be conducted during the implementation of projects.

Eastern region

In 2018, participation in the eastern region was given impetus when the district water boards and provinces initiated an acceleration in the implementation of terrain managers projects. In that same year, a representative of the collective terrain managing organisations was added to the Delta Plan on Freshwater Supply for the East-Netherlands working group; a representative of the agriculture and horticulture sector had already joined in 2017.

Collaboration with the municipalities has also been intensified. In 2018, a working group embarked on the substantiation of the measures scheduled in the second phase of the Delta Plan on Freshwater Supply for the Elevated Sandy Soils. Municipalities and housing corporations are also involved. The eastern region is contributing to the Delta Plan on Spatial Adaptation by, e.g., collecting information on drought to be used in the purview of municipal stress tests.

On 22 November 2018, the Freshwater Supply Region East organised a symposium on the connection between the Delta Plan on Freshwater Supply for the East-Netherlands and spatial adaptation. This symposium marked the start of the second phase of the Delta Plan on Freshwater Supply, which will tie in closely with the Delta Plan on Spatial Adaptation.

Southern region

The Elevated Sandy Soils Delta Plan project group is active in the southern region. It provides a platform for consumers to weigh in on the implementation of measures in such fields as freshwater supply. The consumers are participating in the Meuse Steering Group. Spatial adaptation now also features on this steering group's agenda. This has had a boosting effect on municipal commitment to the freshwater supply tasking.

Background documents and maps

Disaster control, Grintex Pottenkade drill in Dordrecht, Rhine Estuary-Drechtsteden

Background documents and maps

Background Document A
Signal Group recommendations in the context of the six-year review

Background Document B
Progress report: Working on freshwater supply in the delta -
Looking back on 2018 and looking ahead to 2019-2020 (in Dutch)

Background Document C
Fifth progress report regarding Approach to national vital and vulnerable functions (in Dutch)

Background Document D
Advisory report by the Physical Environment Consultative Body and response by the Delta Programme Commissioner (in Dutch)

The maps contained in DP2020 are available for download:

Map 1 Delta Plan on Flood Risk Management
Map 2 Urgent areas in terms of water availability
Map 3 Spatial adaptation Working Regions
Map 4 State of affairs with respect to the Meuse projects

Colophon

Delta Programme 2019 is a publication of the Ministry of Infrastructure and Water Management, the Ministry of Agriculture, Nature, and Food Quality, and the Ministry of the Interior and Kingdom Relations.

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Photos
- Dry pool along the river IJssel, Gelderland: Henri Cormont/InZicht-foto
- (Excessively) low water level in the river Waal, Nijmegen, July 2018: Flip Franssen
- Wolvega-Zuid nature reserve, featuring room for water storage and rainwater collection, June 2019: Tineke Dijkstra Fotografie
- Wave run-up tests, Wadden Sea dyke between Oosterbierum and Sexbierum, November 2018: Jaap Schaaf/Fotobureau Hoge Noorden
- Innovative saline production, Wieringermeer sponge crab farm: Tineke Dijkstra Fotografie
- Spatial adaptation in actual practice, Water Street pilot plant at Delft University of Technology: Tineke Dijkstra Fotografie
- Pannerdensch Canal water control structure, October 2018: Jos van Alphen
- Lob van Gennep, riverbed water storage: Keesjan van den Herik
- Coastal protection near Zoutelande, Southwest Delta, July 2018: Jos van Alphen
- Disaster control, Grintex Pottenkade drill in Dordrecht, Rhine Estuary-Drechtsteden: Thymen Stolk Fotografie

Maps

1	Delta Plan on Flood Risk Management	Delta3
2	Urgent areas in terms of water availability	Rikkers Infographics
3	Working Regions Spatial adaptation	Delta3
4	State of affairs, Meuse Delta Programme projects	Strootman Lanschapsarchitecten

Delta Programme

The Delta Programme is a national programme involving an innovative collaboration between the central government, the provinces, municipalities and district water boards, with input from NGOs, knowledge institutes, residents, and the business community. The aim is to protect the current and future generations of the Netherlands against flooding, to ensure a sufficient supply of fresh water, and to render our country climate-proof and water-resilient in order to prevent major damage. The collaboration is founded on the issues of Flood Risk Management, Freshwater Supply, and Spatial Adaptation and involves close interaction with the regions in which these themes are being elaborated in concrete terms.

The Delta Programme Commissioner submits an annual proposal for the Delta Programme to the Minister of Infrastructure and Water Management, fosters the implementation of the Delta Programme, and monitors its progress. The proposal also comprises three Delta Plans featuring all the measures and provisions scheduled: a Delta Plan on Flood Risk Management, a Delta Plan on Freshwater Supply, and a Delta Plan on Spatial Adaptation. Every year, the Delta Programme is presented to the States General on Prinsjesdag, the official opening of Parliament in September.

www.rijksoverheid.nl/deltaprogramma
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