

Ladies and gentlemen,

Good evening. When I was invited to give a lecture for the Night of the Water, I was quick to accept. The subject being "clever solutions and super tricks" I am convinced that the Dutch Delta Program will be an interesting topic for you. The Delta Program bridges our past and the way we used clever solutions to become the best protected delta in the world, to the future, so that we stay the best protected delta. It is a special program, dealing with an all important issue, with many stakeholders and planning for the long term. Effectively dealing with the challenges a changing world poses for our water safety and fresh water supply asks for a special solution, a different way of governance, and for innovative ways to attain our goals. I will not call it a trick, but it is definitely another clever solution. But let me first frame the issue.

In the Netherlands we have a long history of fighting floods. This is not surprising, as 60% of our country is floodable. Living in a low-lying delta has obvious advantages. Our soil is fertile, there is an abundance of water and the waterways connecting us to the heartland of Europe made it possible to become the gateway to Europe. It also has disadvantages, flooding being the most prominent. Some floods are almost mythical, like the Saint Lucia Flood of 1287, which drastically altered the coast line of the Netherlands, shaping the Wadden Sea and the Zuiderzee. Ten thousands of people died. The second Saint Elisabeth Flood of 1421 shaped the Biesbosch. 72 villages in Zeeland drowned. There are many others, too many to mention. More recently major floods occurred in 1916, around the Zuiderzee, in 1926 along the rivers and especially in 1953, in the Southwest of the Netherlands. Near disasters occurred in 1993/1995 along the rivers. Please have a look at these video fragments.

In the past we responded to disasters by creating elaborate defense works. The flood of 1916 led to the closing off of the Zuiderzee by the Afsluitdijk [click], the flood of 1953 led to the Delta Works and the near disasters of 1993/1995 led to the Room for the River program. Presently the Netherlands is the best protected delta in the world. We have a system of dyke rings, based on high norms laid down in law, the strength of which is checked against that norm every 6 years.

During the last decades of the 20th century the insight grew that human influence on the natural environment had far-reaching effects and might even be influencing the climate. A changing climate has consequences for the way we in the Netherlands approach our safety. An uncertain future gives rise to larger margins of error in calculations of the probability of extreme events. Today I will not go into the debate of whether or not climate change is caused by human action. What is important is that we measure climate change and that we have to deal with that. Also, our norms were established in the years after the big flood of 1953. Since then our population has grown and the value of our assets behind the dykes has increased. There is more to protect.

The insight that modern society can be very vulnerable to extreme events was given impetus in 2005 by Hurricane Katrina. In the Netherlands a state commission was established in 2007, the 2nd Delta Commission. The fundamental question this commission was asked to answer was "How can we make sure that our country will remain an attractive place to live, work, invest and recreate for future generations?". Or, to rephrase it, will it be possible, given the most extreme scenarios, to keep on living in the Netherlands. In 2008 the commission published its findings in the report "Working together with water". The answer was yes, we can, but we need to act to make it possible. The task is not acute, but it is urgent. After all, our Deltaworks took 40 years to construct.

The 2nd Delta Commission formulated 12 recommendations. I will focus on those concerned with the way we have organized the Delta Program. For good reason our governing tradition of "polderen", negotiating and cooperating between governments and stakeholders, finds its origin in the need, dating back to the Middle Ages, for farmers, gentry, and bourgeoisie to work together to keep their feet dry by building dykes or to reclaim land by creating polders. It was against this backdrop of the multilevel governance of water that the 2nd Delta Commission formulated its recommendations.

The Delta Commission came up with an integrated long-term vision of water safety and supply. It recommended strengthening the political and administrative organization of our flood protection by, amongst others, the appointment of a "delta director", to provide cohesive national direction. The idea of a delta director was introduced because the Commission recognized the need for a person who could act as the linking pin between all concerned parties to realize national objectives. In the Netherlands we have the Ministry of Infrastructure and the Environment responsible for policy guidelines, Rijkswaterstaat responsible for the national water system, waterboards responsible for the regional water system, provinces for spatial planning, and municipalities for local spatial planning and the sewer system. None of these organization in itself can solve the problem, so direction is needed.

The title of this functionary came to be "government commissioner". A government commissioner is basically a functionary appointed by the government to a special responsibility. The delta commission also recommended that to ensure the long-term continuity of the Delta Program, a special Delta Act should be drafted, stipulating the setting up of a Delta Program, of a delta fund of around 1 billion euro per year, and stipulating the responsibilities and authority of the government commissioner for the Delta Program. On January 1, 2012, the Delta Act became law. The existence of a Delta Program for water safety and a sufficient water supply, both now and in the future, is thus guaranteed.

Let me turn to what the underlying problems are that the Delta Program needs to solve and how we do this. We live in a safe delta now, but what are the challenges we need to deal with? We measure changes in our environment. Over the last century sea level rose 20 cm. The weather is becoming less predictable. This leads to increased erosion of our coast. We face an increase in the frequency and intensity of both wetter and dryer periods, causing changes in the discharges of our rivers, in turn leading to questions regarding security and our fresh water supply. Our soil is subsiding, creating problems with the management of our water level. We face increased salt intrusion and stronger rainfall. And in relation to this changing climate and its effects, should we develop additional policy on where to build and how to restructure our built-up areas? And on top of this, there is more to protect, so the question is whether our standards are still up to date.

In the past we reacted to disasters, as with the Afsluitdijk or with the Delta works, to become the best protected delta in the world. What is special about the Delta Program is that this time we work not in response to a disaster, but to avoid it. We prepare for the future. This is new and from a governance perspective one could say it is daring.

Although the general direction of future developments is clear, the speed and scale of change are not. Therefore we work with 4 delta scenarios. [slide] These are combinations of socio-economic scenarios and climate scenarios used by our knowledge institutes. We do not choose between them and we do not consider any scenario more likely than another. They sketch the possible futures that we may have to deal with. We use these scenarios to check the robustness of our present day strategy. If we continue with business as usual, when, given a particular scenario, will we reach a point where we cannot guarantee our safety or a sufficient water supply anymore? Such points we call tipping points. A strategy is very robust when it can be successfully maintained under all scenarios and it is least robust when it cannot be maintained under any scenario. Two examples of tipping points are: Lake IJssel in relation to the Waddensea (which has right now a lower surface level) and the open Port of Rotterdam (New Waterway), where during periods of low river flows salt intrusion increasingly harms the fresh water inlets for the agricultural sector upstream.

One way to deal with the inherent uncertainty of future developments is the use of so-called adaptive delta management. Through adaptive delta management we strive to keep our options open as long as possible, so that we keep systemic flexibility. We want to do what is necessary now to keep options open in the future (avoid regret), we take incremental steps that optimize timing of major investments, and we identify opportunities to prepare for measures that will be needed in the future, but for which it is more cost effective to prepare for them now.

This is illustrated by these slides. Along the vertical axis you see increased problems and along the horizontal axis you see time. At a moment in time the problems reach a critical level. Preparing for a measure to counter that takes time and a decision needs to be taken long before to be able to execute that measure in time. Change is in fact not linear, but variable [click] which influences the moment the situation becomes critical. The way we use for instance spatial planning, as in Room for the River, either increases or decreases our problems and moves the critical moment either forward or backward. This is how adaptive measures can help postpone or avoid tipping points.

A good example of a flexible and incremental strategy is the way we defend our coast through sand nourishments. We add sand to our coastline so that the beaches and dunes grow at the same rate the sea level rises. If the sea rises faster, we add a little more sand. This is much more cost effective than preparing major infrastructural works. Take the example of the Sand Engine project. This is a novel way of nourishing the coast with less impact on the ecology. After depositing a huge amount of sand in one go, wind and currents disperse the sand and reinforce our coast. It is an innovation with great potential, also abroad.

In the example of the New Waterway, measures to take pressure off the inlet points for fresh water in danger of salinization are being studied. Another interesting innovation that is currently being tested is a bubble screen to mix fresh and salt water to diminish salt intrusion. By diminishing the effects of salt intrusion we keep our options open regarding the New Waterway, which is so important for our economy.

In the Delta Programme we are on the one hand continuing our work on the Delta, like our Room for the River and Maaswerken projects, and reinforcing the weak links in our coast and other maintenance work that will be ready by 2017. On the other hand we are preparing Delta decisions. These are structuring and fundamental decisions that give direction to the overall long term strategy for water safety and water supply and a new generation of deltaworks. The proposal for delta decisions will be presented to Parliament in 2014 at the opening of the Parliamentary Year, Prinsjesdag.

There are 5 such decisions, three national, on safety standards, on a strategy for fresh water and on spatial adaptation, that is on how and where to build, and two regional, namely on the use of Lake IJssel and on how to solve the puzzle of the Rhine-Meuse Delta, that are being worked on in 3 national and 6 regional subprograms. The program teams of these subprograms are made up of representatives from national, regional and local governments, and involve all stakeholders that both need to be informed on the one hand and that should be able to add their point of view and knowledge to the program on the other. After all, only in this way, by identifying and sharing all the facts, by a transparent process involving all stakeholders, nationally optimized solutions can be reached.

Ladies and gentlemen, summarizing, our approach is based on the following 5 Dutch D's. A Delta Act that provides legal basis to a Delta Programme, a Delta Fund to finance the necessary measures, a Delta Commissioner to guard progress and coherence, and Delta decisions to structure our strategies. I thank you for your patience. I hope that through this short introduction on the Delta Program I have shown you the way we work on our long term water safety and sufficient water supply, thus ensuring the Netherlands remains an attractive place to live, work, invest and recreate for future generations. It is a clever solution to prepare the much needed decisions. But because of the power of images I would like to illustrate my presentation with a short film on the Delta Program. After this short, 6 minutes, film, I will be ready to answer your questions.

Thank you

## Bijlage 1

### Uitleg IJsselmeer en Rotterdam

Our Lake IJssel is our major fresh water lake. During very dry periods, projected to become more frequent in the future, we need a fresh water supply to guarantee the various use functions, but the amount of water presently available from the lake is limited. We would like to increase the available volume or create another basin for freshwater in the Southwest. Another issue is that presently we can let water out of the Lake into the Wadden Sea at low tide under gravitational pull. However, when the sea level rises, the period within the tidal cycle you can do so becomes shorter and shorter and eventually the sea level will be above that of the lake and you will need to pump out the water. This for instance is a tipping point. What to do? Pumping depends on a power supply. We are talking great quantities of water and under extreme conditions the power source must be guaranteed. These are risks for safety. So, you could raise the level of the lake, coincidentally also increasing the water volume as a buffer for dry periods, allowing you to continue letting water flow out. However, increasing the level of the lake has vast consequences for the surrounding provinces, inundating major ecological systems and affecting cities and villages. Balancing the pros and cons, also in terms of cost-benefit, is a tricky job. Should we set up the level of the lake, or not?

Another example is the protection of our main sea port area of Rotterdam. Right now we have a storm surge barrier in place, the Maeslantkering. Presently the frequency of closing for which it is designed is very low, on average once every ten years. With a rising sea level the incidence of closing will increase and a closed Nieuwe Waterweg is bad for business, because shipping will be held up dramatically. At a point in time the frequency becomes higher than economically justifiable. This is another tipping point. What is more, during dry periods we need 700 m<sup>3</sup>/s of the approximately 1000 m<sup>3</sup>/s flowing in at Lobith, the point at our border with Germany where the Rhine enters our country, to flush out intruding salt sea water. Fresh water that we need elsewhere. Closing off the Nieuwe Waterweg would solve this problem, but again, that would be bad for business and trade. Building locks is an option, but would of course lead to delays for shipping traffic compared to the current open shipping lane. When will economic damage due to salt intrusion outweigh the benefit of keeping the Nieuwe Waterweg open? This is also a possible tipping point. The present strategy may no longer be feasible. Given the economic interests and water safety and supply issues at stake, should we keep access to Rotterdam in the long term open or should we decide to close it?