Rijkswaterstaat
*Ministry of Infrastructure and the Environment*

Protecting the Netherlands from flooding

# The Afsluitdijk Project

# 80 years

The Afsluitdijk has been protecting the Netherlands from the sea for more than eighty years. However, the dike no longer meets the current requirements for flood protection. Rijkswaterstaat is therefore going to reinforce the Afsluitdijk. We plan to make the dike overflow-resistant by replacing the outer cladding and will strengthen the sluices and locks. We are also going to install powerful pumps in the sluice complex at Den Oever so that more surplus water can be discharged from the IJsselmeer into the Wadden Sea. The Afsluitdijk's new pumping station is expected to be the largest in Europe.

## Why does the Afsluitdijk need to be reinforced?

1. Flood protection. The climate is changing. As a result, the sea level is rising and extreme weather conditions will occur more frequently. The dike must then still be able to protect us against flooding.
   *The response: to strengthen the dike along its entire length and reinforce all of its components.*

Water management. We use the sluices at Den Oever and Kornwerderzand to discharge excess water from the IJsselmeer into the Wadden Sea. When the water level in the Wadden Sea is low, the sluice gates can open and allow the water in the IJsselmeer to flow into the sea. A growing problem, however, is that they are increasingly unable to discharge enough water
*The response: to install pumps in the sluice complex at Den Oever.*

*Afsluitdijk near Den Oever, Stevin locks*

## A once-in-ten-thousand-years risk

The Afsluitdijk has to offer protection even in severe weather conditions, for example the coincidence of a spring tide and an extreme north-westerly storm. In that event, the water is driven high against the dike and waves crash over it. The dike must not succumb to that pressure. The Afsluitdijk has to be able to meet the once-in-ten-thousand-years criterion, which means it has to be able to withstand any combination of high water and waves with a risk of occurring once in ten thousand years. In other words, it has to be able to cope with what is known as a ‘superstorm’.

## Reinforcing the dike

The outer side of the dike (the side facing the Wadden Sea) will be covered with new cladding which is strong enough to withstand the waves that beat against the dike during a heavy storm. The plan is to make the dike overflow-resistant, which means that the entire dike will be designed in such a way that water can flow over it during a heavy storm without causing problems, because the inner side of the dike (the side facing the IJsselmeer) will be able to cope with the encroaching water.

## Stronger sluices at Den Oever

In Den Oever, in the province of Noord-Holland, we will make the following modifications to strengthen the sluices:

- To protect the navigation locks against extreme water levels and waves, we will install a floodgate, also known as a storm surge barrier, in front of them. This floodgate will remain open during normal conditions, but close if the water rises too high.
- We are going to reinforce the sluice complex. The complex in Den Oever consists of three groups of discharge sluices, with five tubes in each group. Each tube has two sluice gates. We are going to replace the gates and their suspension and strengthen the artificial islands and the jetties.


1. Inner harbour
2. Inner harbour dike
3. Upper navigation lock
4. Lower navigation lock
5. Lock chamber
6. Outer harbour
7. Jetty
8. Discharge sluices

*Den Oever (left: Waddenzee, right: IJsselmeer)*

## Stronger sluices at Kornwerderzand

We are also going to reinforce the sluices at Kornwerderzand in Friesland:

- We will install a new floodgate on the Wadden Sea side, to the north of the existing swing bridges. This will protect the lock complex with a minimum of damage to this area of cultural-historical importance.
- As at Den Oever, we are going to strengthen the discharge sluice complex at Kornwerderzand by replacing the gates and their suspension and reinforcing the artificial island and the jetties. We will also increase the stability of the complex, which consists of two groups of discharge sluices with five tubes each.


1. Inner harbour
2. Inner harbour dike
3. Upper navigation lock
4. Lower navigation lock
5. Lock chambers
6. Dwellings
7. Kazematten Museum
8. Outer harbour
9. Jetty
10. Discharge sluices

*Kornwerderzand (left: Wadden Sea, right: IJsselmeer)*

### Installing pumps in discharge sluices

We use the discharge sluices at Den Oever and Kornwerderzand to discharge excess water from the IJsselmeer into the Wadden Sea. If the water level in the Wadden Sea is lower than in the IJsselmeer, the gates in the discharge sluices can open and water can flow from the IJsselmeer into the sea. However, because of the rising sea level there will be less and less time to discharge the water. Furthermore, the volume of water entering the IJsselmeer via the IJssel river in peak periods will increase in the coming decades because of climate change.

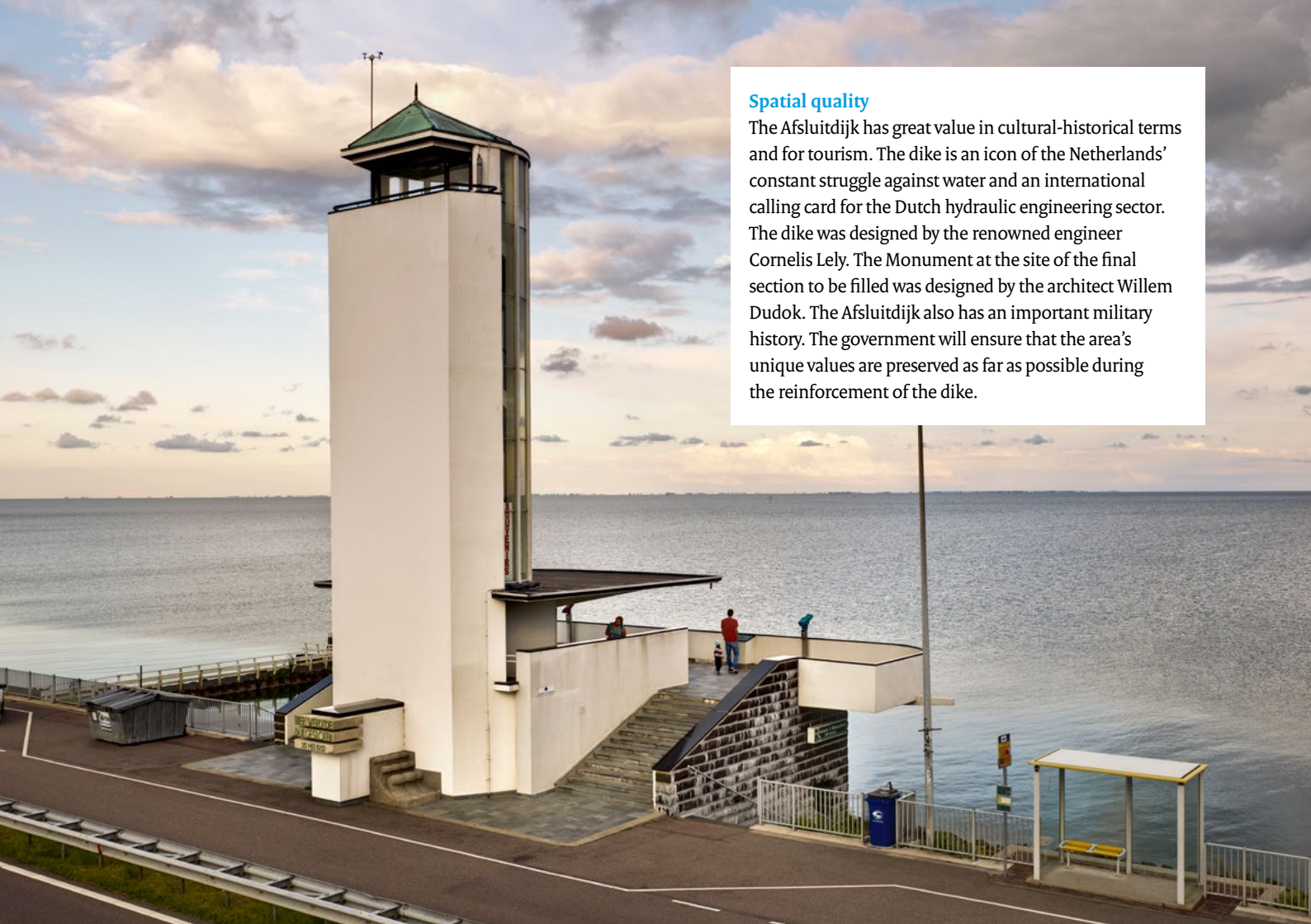
By installing pumps in the discharge sluices at Den Oever, we will in future be able to discharge water from the IJsselmeer even when the water level in the Wadden Sea is high and so increase the discharge capacity. The new pumps will be able to pump more than four hundred cubic metres per second, which is roughly the equivalent of ten Olympic-size swimming pools every minute. The Afsluitdijk's new pumping station is expected to be the largest in Europe. Space will be left so that additional pumps can be installed in the future if necessary. In this way, Rijkswaterstaat will be able to maintain the water level in the IJsselmeer at its current height until at least 2050.

## Adaptive delta management

The pumps at Den Oever will be installed in stages. This will enable us to respond to the actual pace of the rise in the sea level and allow us always to make use of the latest technologies and provide solutions that remain effective in the longer term. This is an example of adaptive delta management, a method we are also employing in the reinforcement of the dike. The measures we are now implementing will keep the dike safe at least until 2050 and make it relatively easy to adopt additional measures for the ensuing period until 2100.

## Nature

The Afsluitdijk separates the Wadden Sea from the IJsselmeer, two areas of unique natural beauty. We will take account of that during the preparation and execution of the project. For example, water birds rest and forage in the shadow of the dike. At some locations, therefore, we will not be working all the year round. Seals also need peace and quiet, and we will respect that by setting limits for the noise level during the work.



## Spatial quality

The Afsluitdijk has great value in cultural-historical terms and for tourism. The dike is an icon of the Netherlands' constant struggle against water and an international calling card for the Dutch hydraulic engineering sector. The dike was designed by the renowned engineer Cornelis Lely. The Monument at the site of the final section to be filled was designed by the architect Willem Dudok. The Afsluitdijk also has an important military history. The government will ensure that the area's unique values are preserved as far as possible during the reinforcement of the dike.

## Cooperation with the region

Rijkswaterstaat's primary responsibilities during this project are for ensuring the dike's safety and for water management. The central government and regional authorities have also formulated ambitions in areas such as renewable energy, nature development, recreation and tourism. These ambitions have led to numerous initiatives, including the construction of a recreational cycle path on the Wadden Sea side of the dike, improvements to the public space around the Monument and the upgrading of facilities, a number of pilot projects with renewable energy, an innovative art project with innovator Daan Roosegaarde, the construction of a fish passage and a fish migration river that will allow fish to swim from salt to fresh water. Regional authorities are taking the lead in many of these initiatives and will flesh out the details in consultation with the central government. Together, we are building a safe, sustainable, attractive and future-proof dike.

## Cooperation internationally

Rijkswaterstaat works across bordes with neighboring countries and international partners also facing challenges when it comes to water management. We exchange knowledge and experiences globally about dike reinforcement and the preservation of nature. This creates a strong international network of partnerships and leads to smarter and more effective solutions for everyone.

## Planning

The Afsluitdijk project is expected to start in 2018 and is due to be completed in 2022.

## Website

www.deafsluitdijk.nl

*Kazemat near Kornwerderzand*

## History

The region around the former Zuiderzee was vulnerable to flooding. There were already plans to build a causeway in the 17th century. In 1916, a combination of a storm at sea and an enormous surge of water from the IJssel caused flooding in large parts of the area around the Zuiderzee. Dikes burst, people were killed and the damage was enormous. There had already been plans to tame the Zuiderzee for some time, and the engineer Cornelis Lely was now asked to produce a plan for the construction of the Afsluitdijk. Work began in 1927, and the last section was completed in 1932. That section was located at the point where the Monument designed by Willem Dudok now stands. Near the Monument stands the sculpture of a stone cutter, a memorial to the five thousand workers who built the Afsluitdijk.

*Sculpture of the stone cutter*

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