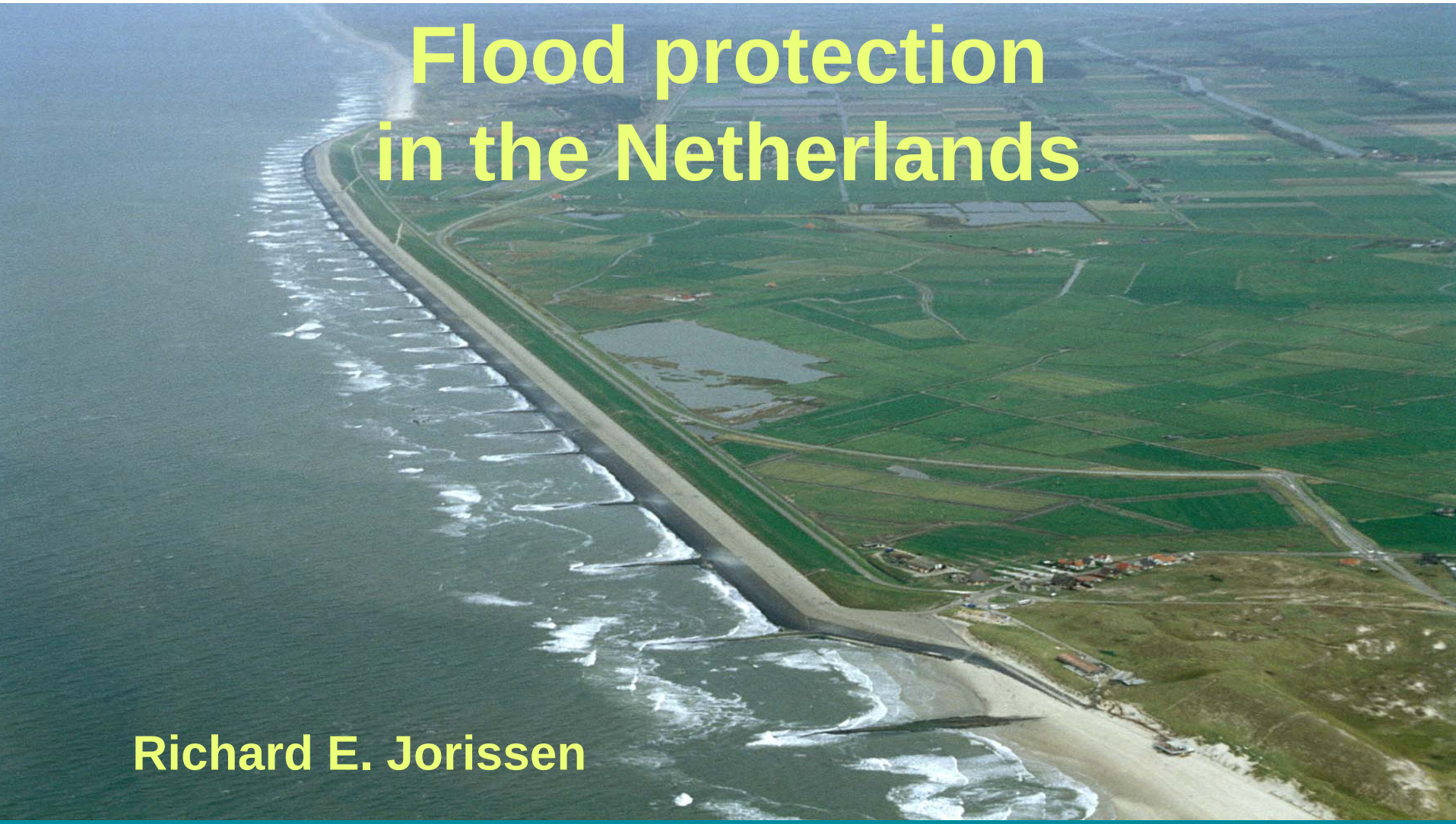
Ministerie van Verkeer en Waterstaat

Rijkswaterstaat

Flood protection in the Netherlands

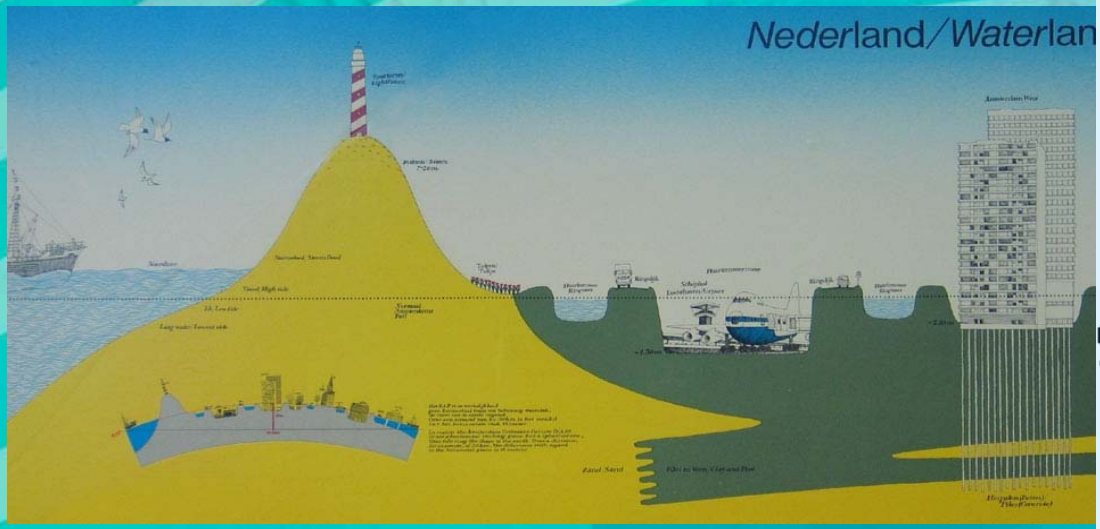


Richard E. Jorissen

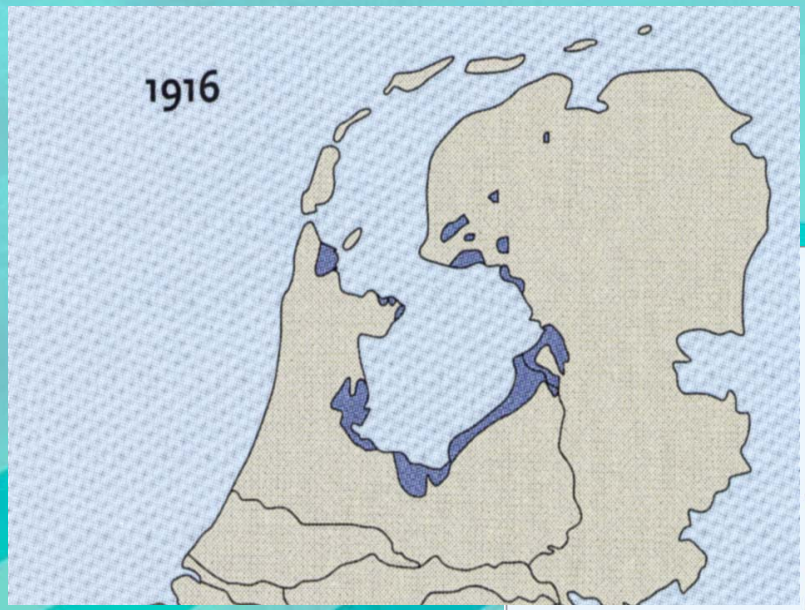
Introduction

Flood protection is vital for the Netherlands:

- 60% of our country is threatened by floods
- 70% of our GNP (450 billion €) is threatened by floods
- large cities like Amsterdam and Rotterdam are below mean sea level

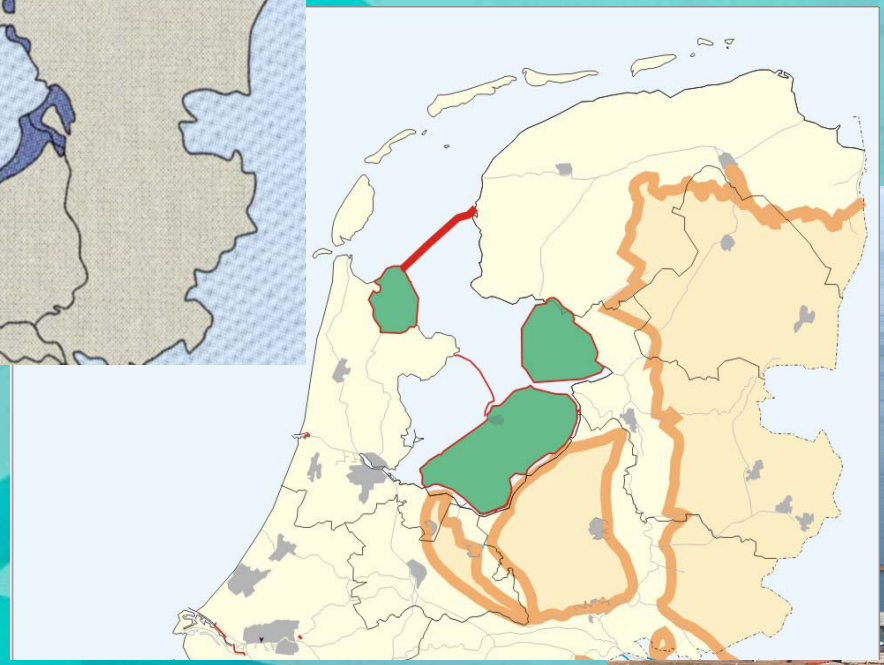


Floods 1916



1932: Closure of ‘Zuiderzee’

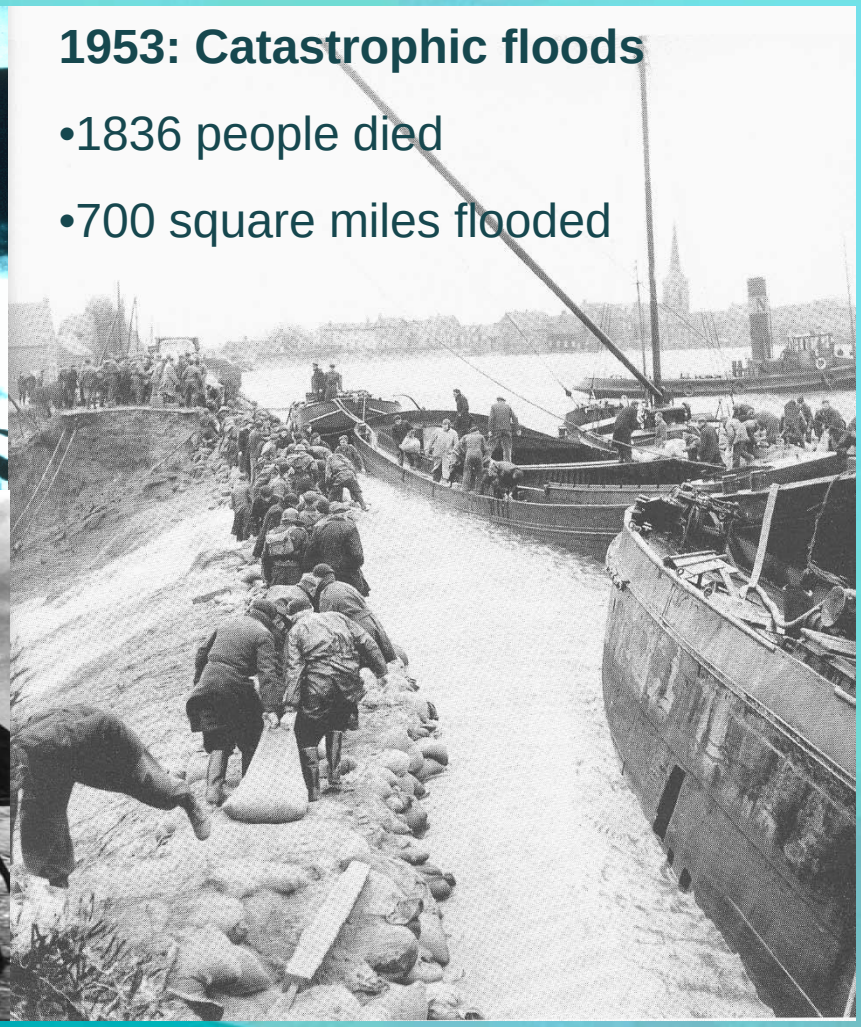
•land reclamation, flood protection and fresh water supply



Floods 1953 and the Deltaplan

1953: Catastrophic floods

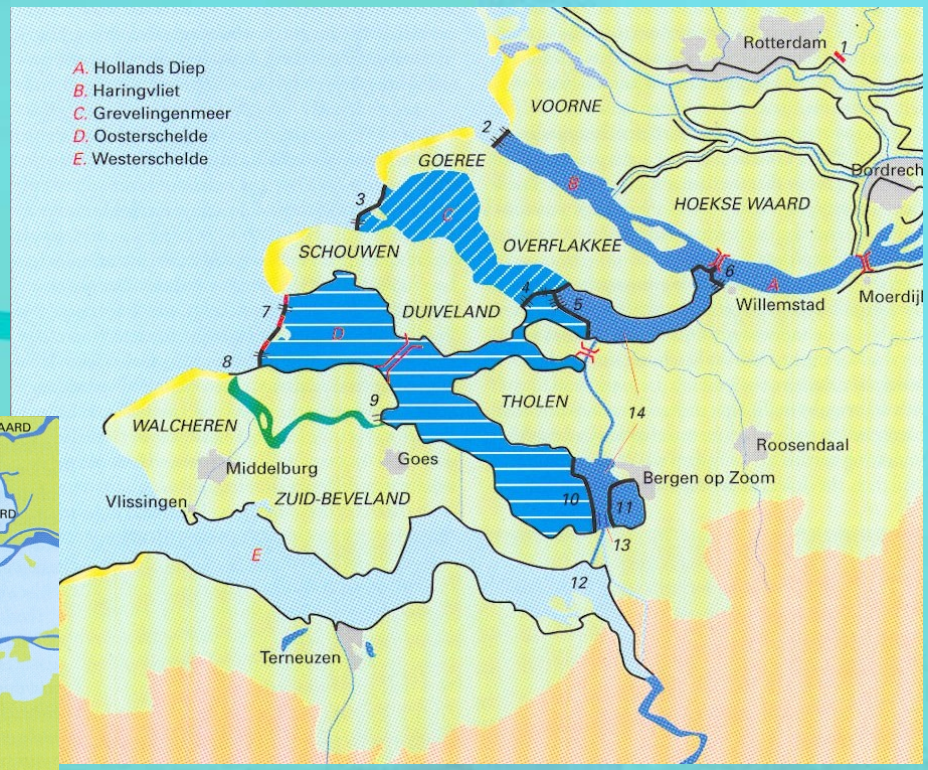
- 1836 people died
- 700 square miles flooded



Floods 1953 and the Deltaplan

A new start with:

- closing off estuaries
- safety standards, based on economics
- national dike improvement scheme



Present safety framework

Safety is accomplished by:

- maintaining the coastline and compensating coastal erosion
- increasing discharge capacity of the major rivers
- maintaining flood protection structures
- providing information (flood warning), conducting research and issuing guidelines

Authorities involved

National government/Rijkswaterstaat

•legislation, safety standards, guidelines and hydraulic boundary conditions (sea level rise, .., ..)

•financing the reinforcement of water defenses

•management and maintenance of coastline, rivers, large lakes and large dams/barriers

Waterboards:

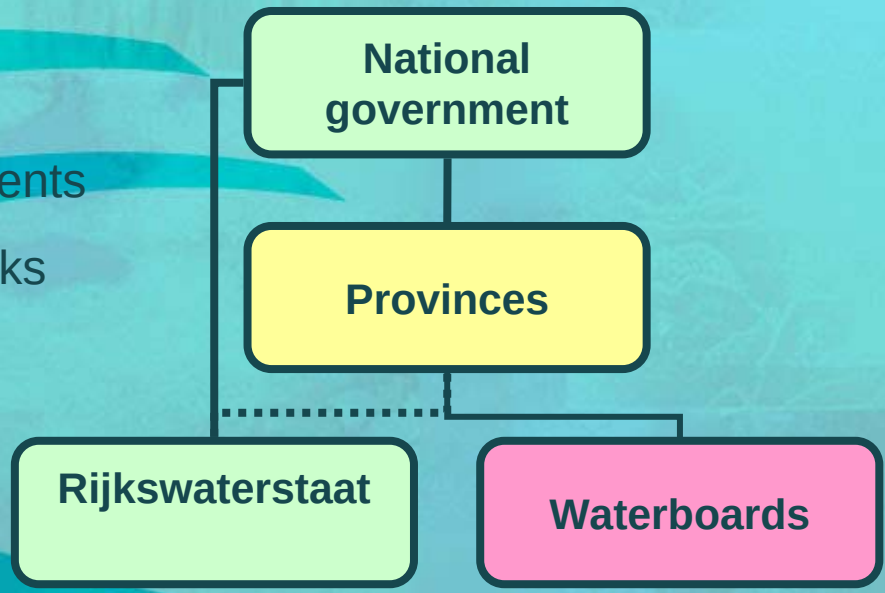
•management and maintenance embankments

•safety assessment and reinforcement works

Provinces:

•regional supervision

•spatial planning



Coastal management (I)

- coastal management policy is based on holding the coastline of 1990 and compensating for sand losses in the foreshore
- holding the line (in red) takes about 8 million yd3 sand per year; compensating sand losses (in blue) in the foreshore about the same
- Rijkswaterstaat carries out a coastal management programme of 16 million yd3 per year (43 million €/year)
- if sea level rise increases from 8 to 30 inch/century, the nourishment volume increases from 16 to 40 million yd3 per year

Coastal management (II)

•coastal management is based on beach and foreshore nourishment

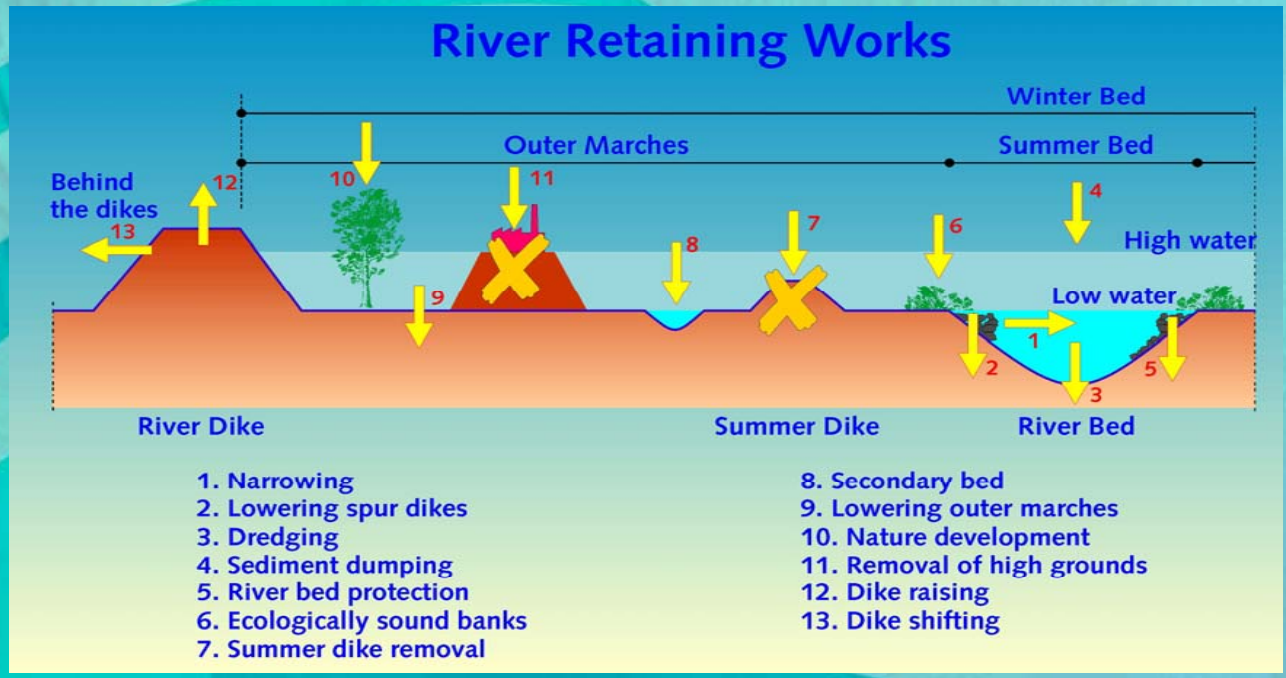
River management

•increasing design discharges would lead to another heightening and reinforcement of river embankments

•widening, deepening and smoothening the river bed accommodate increased discharges

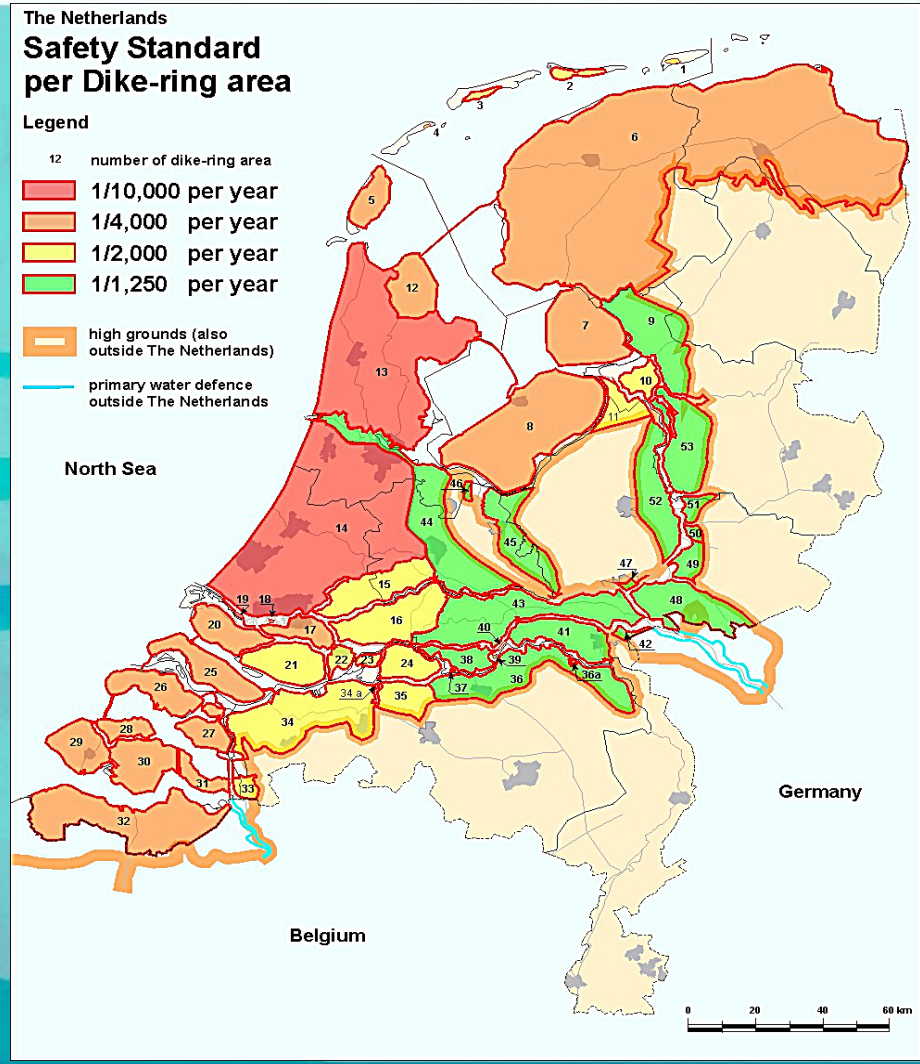
•project costs for the ministry are 2,4 billion €

•future management and maintenance is not yet estimated



Flood protection structures (I)

- approximately 2200 miles primary flood protection structures with legally prescribed safety standard
- largely (90%) managed by water boards; maintenance costs (150 million €/year) are raised by local taxation
- Rijkswaterstaat manages large, complex and costly (100 million €/year) structures
- reconstruction works are paid for by the ministry (100 million €/year rising to 200 million €/year in 2010)
- secondary flood protection structures are the responsibility of provinces and waterboards



Flood protection structures (II)

Dunes as a natural protection

• sometimes a robust and natural protection

• sometimes on the edge of safety

Coastal levees

- typical crest level of 40-45 feet above MSL

The Easternscheldt Barrier

• largest and most complex closure of the Deltaplan, following the floods of 1953

• completed in 1986

The Rotterdam barrier

• an addition to the original Deltaplan as an alternative to raising river levees in urban areas

• completed in 1997

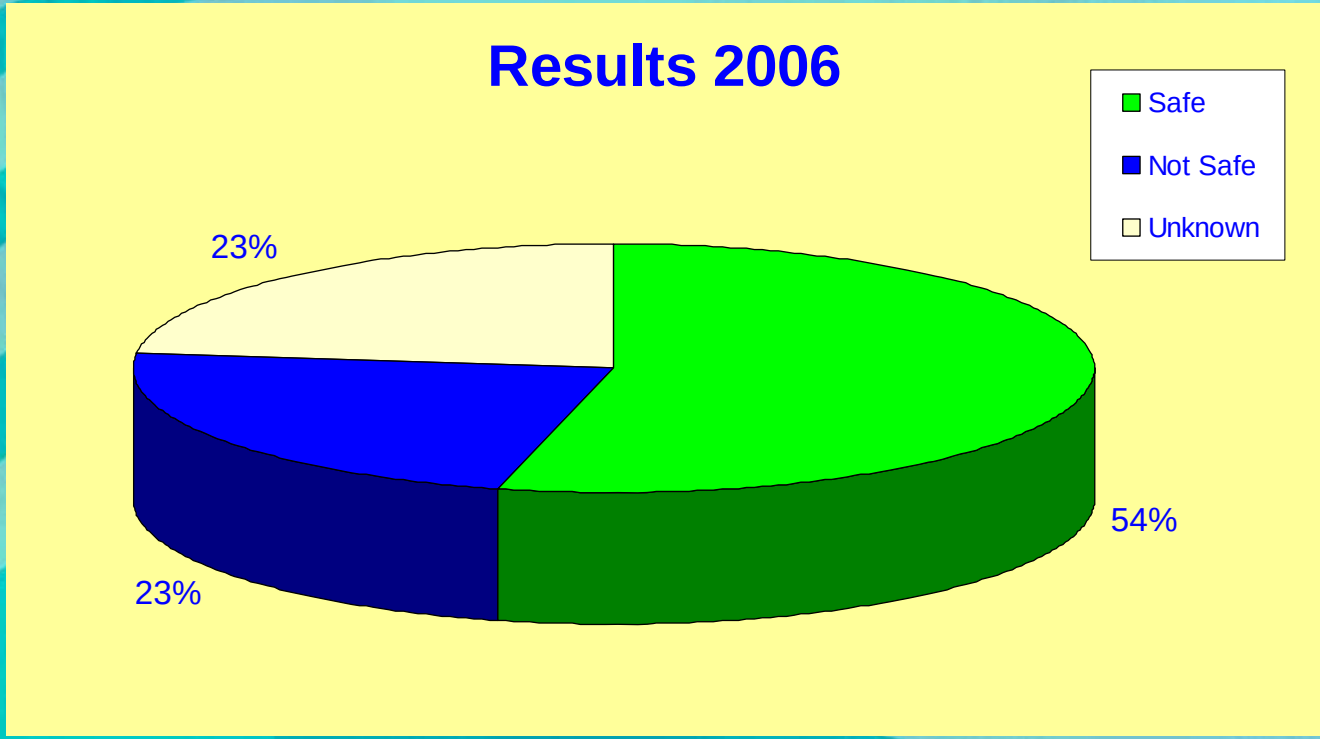
Safety assessment

Safety assessment:

• carried out every 5 years by the local waterboards (since 2001)

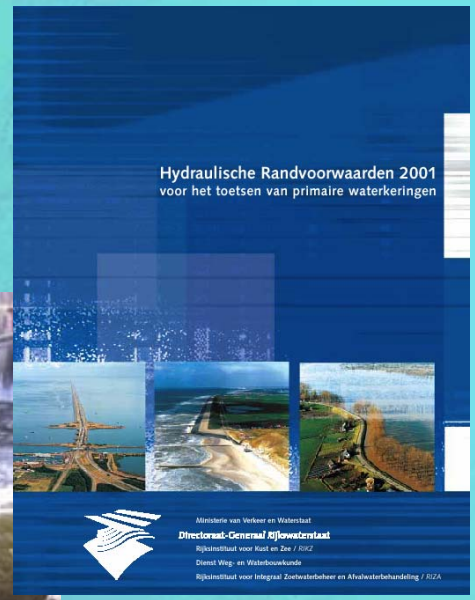
Provided by the central government:

•hydraulic boundary conditions and technical criteria



Information and research

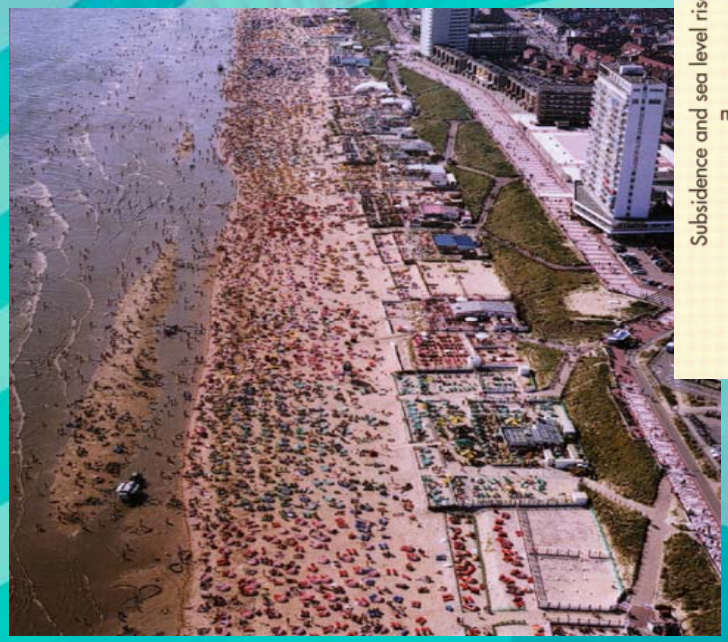
- storm surge and flood warning services
- guidelines for design and maintenance of flood protection structures
- research programme
- largely financed by the ministry: approximately 10 million €/year

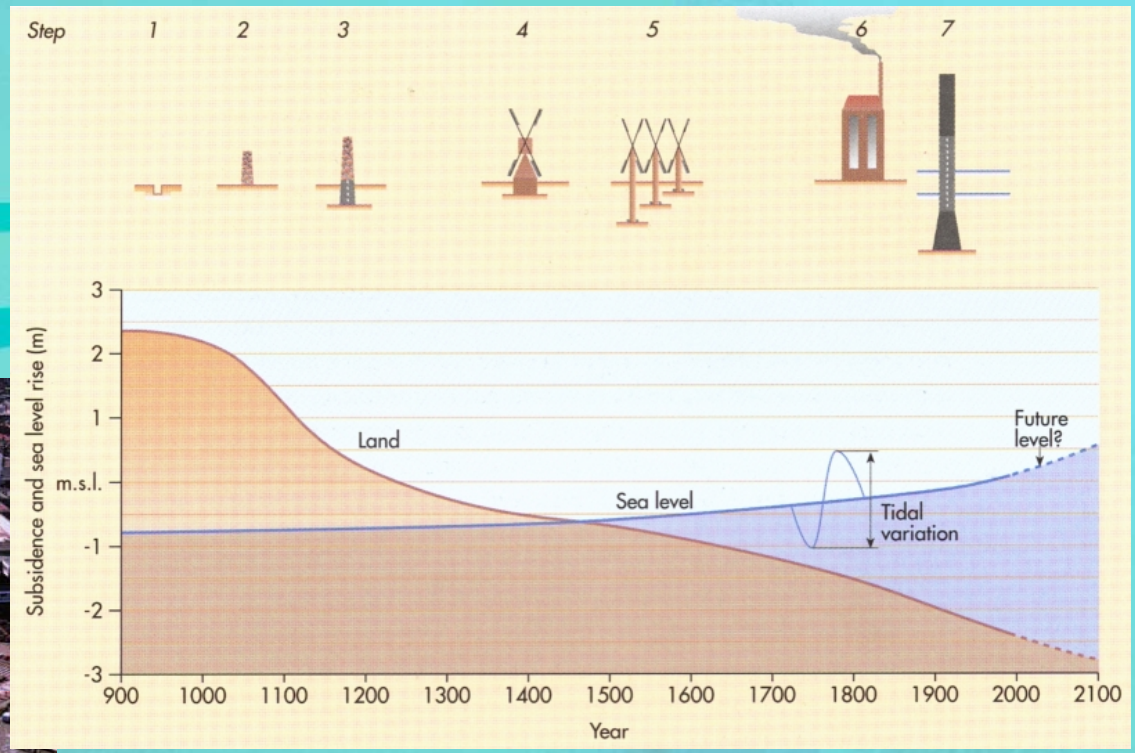


Future developments

Where do we go from here?

- sea level rise
- drainage, compaction
- societal developments





Future developments

Safety versus risk:

• the lower circle depicts the present policy of maintaining a fixed safety level (sea level rise, technical developments)

•the upper circle shows the risk-based policy development, which may lead to different standards and/or different measures