**THE SOCIAL AND INSTITUTIONAL CONTEXT OF THE SAND MOTOR**

### Dutch coastal management history
Historically, socio-economic activities in the Netherlands have been mainly concentrated in the estuaries of the Rhine and Meuse rivers. The urban sprawl resulting from this activity is currently in conflict with a large share of the Dutch economic productivity, not to mention its population. In an area so close to the North Sea and with such socio-economic importance, coastal protection is a prime requirement. For centuries, the general principle of coastal protection in the Netherlands was building embankments to protect areas in danger of flooding from the sea.

Relying on embankments for coastal management continued in the 20th century (Figure 1). The last large-scale coastal management program in the Netherlands that relied primarily on embankments were the Zuiderzee works (Southern Sea Works). As a result, embankments were built and fortified, as protection against nature. However, major flooding in 1916, this program intended to reduce the coastline of the Netherlands by closing off the Zuiderzee, which was subsequently called the (ijsselmeer) Lake Ijsselmeer. Reducing the coastline would simplify maintenance of coastal protection works and decrease the protection needs in closed-off regions. Among other things, the Zuiderzee works included the construction of the Afsluitdijk (Closure Dam), a 32.5 km long causeway through the Wadden Sea connecting the Dutch provinces of Friesland and North Holland.

With a man aim of coastal protection, the Southern Sea Works can be viewed as a monofunctional project. Limiting the coastal protection against monofunctionality was possible, because the flood events triggered a heightened sense of urgency, while population pressure was still low in the first half of the 20th century.

In 1953, the southwest of the Netherlands was struck by another major flood event: a Northwesterly storm combined with spring tide. Embankments in different places succumbed to the ferocity of the storm. As a result, 1,800 inhabitants perished and economic damage was high. The disaster came to be known as De Wateren Ramp (The Flood Disaster) and is a pivotal event in modern Dutch history. In the wake of the storm, the Dutch government convened a commission of high-ranking coastal management and civil engineering experts to draft a strategic plan to prevent a similar disaster from ever happening again. This so-called First Delta Committee Plan came to be known as the Zaterplan. It proposed closing off additional inland waters utilizing newly available steel-and-concrete engineering technology. Again, these structures were to be built against nature and serve the sole function of coastal protection.

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Nature promotes an ecosystem perspective; not only minimizing ecological damage, but also developing nature and using natural processes for societal aims.

A pilot project was proposed that would experiment with many functions at once. And thus, the idea for a Sand Motor, in some ways a scaled-up version of previous nourishments, was born. The Sand Motor was designed to utilize natural North Sea currents. In that way, it would serve coastal protection on location and, by deliberate erosion and re-sedimentation, at other locations as well. In addition, the Sand Motor provided opportunities for developing nature, recreation and leisure opportunities, as well as promoting economic productivity.

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**Figure 1. Timeline of Dutch flood risk management in the 20th century. (Photo credits: De Watersnoodramp, Delta Works, Route the nourishment project, Southern Sea Works, Eastern Schelde Storm Surge Barrier, Sand Motor, Haseltien Barrier, Honsdossche Dunes: Blokzijl)**
large-scale building with nature design put into practice. It is no surprise that the Sand Motor was developed in the province of South Holland. This province is home to a large part of the urban conglomerate known as the Randstad, and the province is faced with significant spatial problems associated with population density. At the same time, leisure areas for inhabitants of the growing cities were becoming scarcer. The European Natura 2000 legislation required construction projects to include nature compensation, which was becoming more and more difficult to achieve. The Sand Motor offered an opportunity to innovate with spatial policies, and the provincial government seized this opportunity with both hands.

The arena of Dutch coastal management

The overall Dutch coastal management ambitions were stated in the 2009 National Water Plan. First, the coastal foundation is to grow proportionally to sea-level rise. Second, this process is to be stimulated using sand and the natural dispersion of this sand along the coast. Third, in addition to coastal protection, coastal management should focus on a balanced development of nature, economy and recreation.

The 2009 Water Act remains the main water and coastal management policy in the Netherlands. It relates water management to other policy areas, such as nature, environment and spatial planning. The Water Act distinguishes two water authorities. Water authorities manage coasts within their territory, while the State deals with coastal issues that overlap the boundaries of the water authorities. Water authorities have the task of planning, building and maintaining regional coastal management projects, as long as the coastal stretch in question is not a primary defense structure. The national government defines strategic policy and manages supra-regional defense structures.

Rijkswaterstaat is the national executive agency entrusted with the coastal management program. This has been in place since the formulation of a reference coastline in 1990, beyond which the Dutch coastline is not supposed to erode. Rijkswaterstaat subscribes annual inspections of the coastline, leading to nourishment activities, where necessary. Every four years, Rijkswaterstaat compiles a long-range nourishment plan, with an annual budget of 12 million m³ sand for immediate nourishment (Figure 2). Rijkswaterstaat also oversees applications for integrated water permits, which have to be requested when flood defense structures are constructed or modified. Such projects also need an environmental impact assessment, which evaluates the environmental impact of a preferred solution and compares it to alternative solutions.

Under the Water Act, provincial governments are not considered as water authorities. Nevertheless, they are thoroughly involved in water management, supervising regional water authorities and municipalities and coordinating their activities. Provinicial governments have a significant influence on the coastal management process thanks to their role of approving project plans. Like provincial governments, municipalities do not officially count as water authorities, although they do have certain water management tasks unrelated to coastal management. Although they are not responsible for coastal safety and spatial planning, municipalities are responsible for zoning plans. In the zoning process, other actors who might be affected by coastal management — such as drinking water companies, nature NGOs or knowledge institutes — can influence the decision-making process through the general public participation mechanisms in place.

Second Delta committee advocates a coastal management approach that ensures long-term flood protection and freshwater management strategies.

Although this legal and political structure represents the legal blueprint for coastal management projects, this is certainly not the only way such projects can be organized. While non-experimental projects are generally initiated and managed by water authorities under the Water Act, experimental projects can be carried out by coastal management actors, as was the case with the Sand Motor.

Figure 2. Annual nourishment volumes in the Netherlands since 1991; the 21.5 million m³ of the Sand Motor is not included in the graph. (Figure by Rijkswaterstaat)