

'Building with Nature': principles and examples

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Introduction to the principles

'Go with the Flow'. Find integrated solutions which make use of less invasive techniques and are more in harmony with the natural dynamics. This is the essence of the concept: '*Building with Nature*'.

Although this principle was first applied in the Netherlands, it has gradually been recognised worldwide as a harmonious means of creating land areas for living, working, tourism and recreation, and infrastructure, whilst ensuring the preservation or expansion of valuable environmental resources, nature and landscape. In addition, it also takes into account: climate change and the resulting in sea-level rise, more frequent and intense storm-surges, as well as land subsidence and salt-water intrusion.

Today implementation of this concept is gradually being pursued in a wide range of cities, ports and along beaches throughout the world. In recent years, '*Building with Nature*' has steadily gained more and more acceptance. This is spurred on by the growing awareness on the impacts of climate change, by the increase in natural disasters like the tsunamis in the Far East and hurricanes in New Orleans, and by the loss of low-lying lands, such as the Sundarban Islands in the fragile delta area near the Bay of Bengal.

This approach to innovative coastal measures, with emphasis on soft solutions provides the best hope for long-term sustainable solutions for the restoration of coastlines and habitats and land reclamation.

With approximately 80 percent of the largest population centres in the world situated on coasts and deltas, the need for sound, integrated coastal zone development via '*Building with Nature*' is urgent and appropriate. The flexible integration of land-in-water and of water-in-land (working with nature) is an environmentally friendly and economically advantageous system which is gaining more and more acceptance worldwide. Implementing this approach can help create a new flexible coastline in a dynamic equilibrium using sand from the sea, which consists of a new primary range of dunes with a new beach in front and with a minimum of solid sea-wall elements. The emphasis is no longer on inflexible solid bulkheads against the sea, like dams & dykes, but instead on flexible soft structures in harmony with the sea, like dunes & beaches.

The Netherlands is a good example of a low-lying coastal country with a high population density. It also has a high motorcar density, a high waste production and a high energy usage per capita. The need for new building sites for living, working, recreation & tourism, for an adequate infrastructure and for a continued town renovation process is clear. At the same time the preservation and expansion of valuable environment, nature and landscape is important. In short there is a need for multifunctional space, which is in short supply.

Apart from the necessity of population stabilisation in due time, in principle three spatial solutions exist to cope with this scarcity of space:

- Making better use of the 3rd dimension (sky-scraping & underground development);
- Using space in the existing hinterland;
- The seaward option with flexible integration of land in water and of water in land.

The emphasis here is on the seaward option, which is based on two important principles: *Integrated Coastal Policy* and *Building with Nature*.

Integrated Coastal Policy with a sustainable, integrated approach for many coastal and delta regions worldwide, and to achieve this, many functions, using many different disciplines, have to be considered carefully. The final development should be such that the overall economy is strengthened and the environment is improved. There are many specific functions in the coastal zone which are of great importance and which should be addressed in cohesion, requesting an integrated, holistic approach.

Where nature allows it, the principle of 'Building with Nature' should be applied as much as possible in the creation of new land. The essence of this principle lies in understanding the natural forces and interactions between the land and the sea. Being flexible and working with rather than against natural forces and taking into account existing and potential natural values of the coastal zone and the seabed, is essential. 'Building with nature' uses the mobile material sand/silt and the forces/interactions to which they are exposed being the action of tides, waves, currents, river outflow and interaction vegetation - sand/silt.

Multifunctional master concepts including nature reserve areas and careful zoning, can achieve a net gain in coastal areas. These coastal zone developments can be carried out phase after phase, segment after segment, all fitting in a flexible master plan, leading not only to cost-effectiveness and flexibility but also to environmental improvement. The environment, including nature, has four important basic functions:

1. *Carrier Function*, providing space and habitat/substrate for all living organisms encompassing inorganic matter, landscape and seascape, energy systems and the interactive processes;
2. *Production Function*, through exploration, exploitation, harvesting of inorganic and organic resources;
3. *Regulatory Function*, maintaining essential eco-systems and processes, including the bio-geochemical cycle, the climate and hydrological cycle.
4. *Information Function*, providing information in many forms for increasing the knowledge base of the socio-economic and natural coastal sub-systems enhancing the quality of decision-making.

Strengthening the economy and improving the environment are achieved through the application of the method of *Building with Nature*, the creation of new nature reserve areas, careful zoning of the various functions and the introduction of a Triple-C approach: *Clean Technology, Clean Products, and Cleaning-up Technology*.

Advanced technologies, specially dedicated environmental equipment like drag and cutter dredging heads, improved working methods and technologies for site investigations, environmental impact assessments and sophisticated monitoring and database management, have made it possible to undertake the enormous land-creation projects in the Netherlands, Dubai, Singapore, Hong Kong, in a way that supports responsible socio-economic growth.

Some examples of 'Building with Nature' projects in the Netherlands

Most of the projects have a dune-beach protection in harmony with the sea. They all strive successfully for net nature gain in agreement with economic and social functions.

Two examples are realised integrated multi-functional



Figure 1: Index map: Locations of two of the realised integrated multifunctional coastal 'Building with Nature' projects (blue circles) : #1 Slufterdune area and #3 IJmuiden, and one project under construction: #2 Hoek van Holland – Scheveningen/The Hague (green oval). (source R. Waterman)

projects Slufterdune and IJmuiden, and one is under construction.

The Slufter dune area (800 ha) with its successor Maasplaine 2 (Maasvlakte 2 – 2000 ha) form together a multi-functional peninsula attached to the Port of Rotterdam (Figure 2).

The north side is an area designated for port and port-related activities developed in accordance with environmental standards. This includes a container handling area, chemical factories, roll-on-roll-off, bulk storage and distribution area, with pipeline, railway and road systems, cranes, quay walls and harbour basins, and an environment-friendly storage and processing facilities for all types of wastes such as fly ash, slag, waste gypsum.

The large containment reservoir, 90 million m³ (internal depth - 28 m Mean Sea Level and surrounded by 25 m high dunes) is gradually filled with contaminated dredged harbour sediments. The 35 million m³ sand released during the construction of this deep reservoir is used for the construction of the sandy ring walls of the peninsula. The walls and bottom of the special storage basins are impermeable, preventing leakage to the environment. Excess water is pumped into special treatment unit.

South east of the large reservoir is a triptych of newly designed and existing nature reserves for terrestrial flora and fauna. Next to this is an existing valuable nature

reserve with over 700 species of plants, varying from the pioneer vegetation near the shore to the climax vegetation in the wooded inland area. Adjacent is a developing seascape (clearly visible in air photo) consisting of shoals and beaches with high water resting areas for birds and nursery habitat for marine organisms, like seals.

In both areas provisions have been made for tourism and recreation facilities. A special designed area is used for sea kite- and wind surfing.

Seaport Marine IJmuiden/Kennemer beach –Project

This project illustrates the beneficial application of *Building with Nature* in the area, south of the harbour mole. It was primarily created by the long shore net sand transport in northern direction. Since the 1970s, the sand was trapped by the extended southern harbour mole of IJmuiden. In this way the project started to come into being and *Building with Nature* found its expression. It is a multifunctional land reclamation in IJmuiden, near the entrance channel

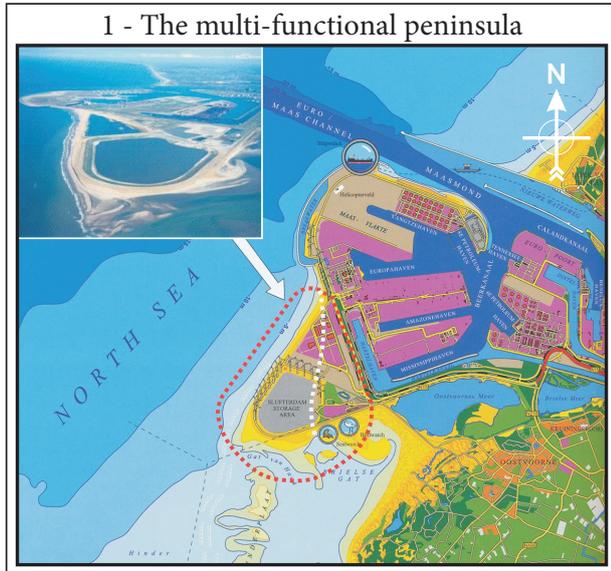


Figure 2: #1. The Sulferdune area connected to the Rotterdam harbour: the large containment reservoir for contaminated dredged material (aerial photograph), the distribution harbour area, and marine and coastal nature reserve area. (source: R. Waterman)

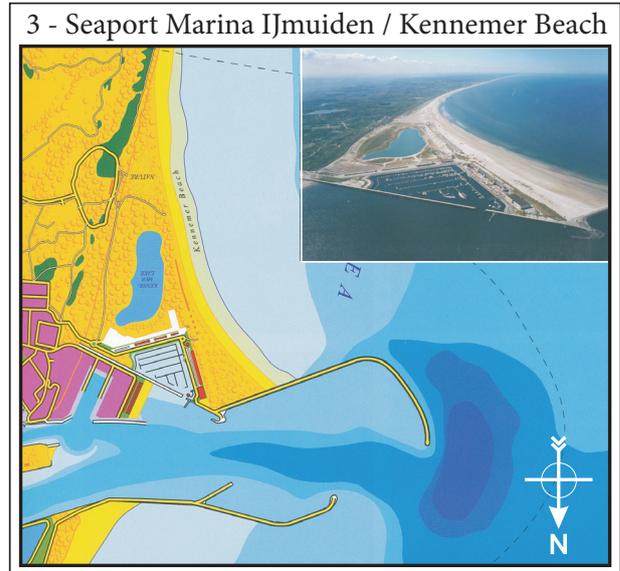


Figure 4: #3. Seaport Marina IJmuiden / Kennemer Beach (looking to the south). Nature already developed a new area south of the existing southern harbour mole of IJmuiden, owing to littoral sand transport in a northern direction along the coast. The process was quickened by human induced action – dredging of external and internal waters, and extending of the harbour moles. (source: R. Waterman)

2 - Wedge shaped land reclamation: The Hague - HvHolland



Figure 3: #2. Wedge shaped land reclamation between Hoek van Holland/Rotterdam and The Hague (with a length of 21 km and with a maximum width of 4 km) seawards of the red line being the present coast line; with several functions: lagoons, nature reserve area, marina, harbour, residential area, recreation, with increased fresh water lens under the new dunes, and increased coastal protection anticipating climate change. The total project is being executed segment for segment. (source: R. Waterman)

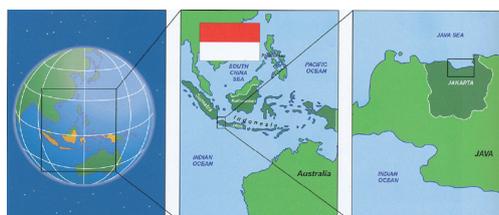


Figure 5: *Jakarta proposed land reclamation in purple: port and industry, and in light green: residential area and nature reserve areas.* (source: R. Waterman)

to the Port of Amsterdam, with a marina, a double boulevard, a nautical centre, apartments, restaurants & shops, hotel capacity and an artificial lake, attracting many birds. Parts of the wide beach, close to Amsterdam, is also used for recreation.

Building with Nature in South Asia: Jakarta Waterfront Development Programme: Pantura project

Jakarta is an example of a densely populated coastal urban agglomeration, over 10 million inhabitants, living and working on an area of 650 km². Although Jakarta faces enormous current and future problems, it also presents an important opportunity to solve these problems. A holistic, *Building with Nature* approach relied on using the natural hydraulic forces and interactions between sand and silt. This approach to land reclamation is relatively cheap, environmentally friendly and more in harmony with nature and therefore more sustainable. The Pantura project comprises the creation of over 3000 ha of new land along 32 km coastline of Jakarta Bay. The development of

this newly acquired land is coupled to a complete urban rehabilitation of 2,500 ha of the adjacent hinterland of North Jakarta (Utara). Included are many different functions ranging from residential areas, industry to establishing a segment for a new nature reserve including indigenous flora and fauna, with in sandy beaches, dunes and mangrove coasts. Special attention has to be paid to ensuring a harmonious transition from old to new, including cultural and historical values. Private and public sectors can work together to realise an integrated vision: the Rebirth of Jakarta.

Conclusions

Over recent years, the necessity of an *Integrated Coastal Policy* via *Building with Nature* has become more apparent, not only in Europe but also elsewhere in the world. The overall investments and maintenance costs of the methods based on these principles are significantly lower than those that neither use an integrated approach nor use the environment as a basis for development. Furthermore, the proposed method improves the environment and simultaneously strengthens the economy. The concept has proved to be applicable in a large number of countries in coastal and delta areas.

Integrated planning aimed at long term sustainable development of coastal areas which addresses complex coastal problems takes time. However this “loss of time” is regained during the execution and the implementation of the comprehensive coastal projects.

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