Longue Durée: Editorial

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Models over Time

Waterloopbos and Mississippi River Basin

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The development of knowledge about the mechanism in the delta has had a high dependency on projects and techniques available. During the period from 1930 to 1939, there is a consolidation of the achievements and further development of hydraulic engineering techniques, based on model-based and mathematical analyses and prognoses (Schot et al., 1998). In this time two of the physical models were built, the Waterloopbos in the Netherlands and the Mississippi River basin in the USA. Both models have been used extensively to expand knowledge and build projects, but both became out of use when computers appeared in the 1980s. Then the calculation models were favoured, as they can be done faster, and are also capable of handling complex problems. Computer technology became increasingly dominated by measurement, prognosis, calibration, verification and validation. For this project section, the current state of the two models is brought forth as a new technique in which maybe the Longue Duree of the relation between humans and nature can become evident.

The model of the Water City part of Rotterdam.
On the right the Binnenhaven and on the right
Noordereiland, the middle is the river Maas (1956).
Source: Beeldbank

WATERLOOPBOS

The Waterloopbos is a waterworks park located in Marknesse, in the Noordoostpolder. It consists of a series of scale models built to support a new way of doing research for fighting the Dutch 'common water wolf' as efficiently as possible. By testing new hydraulic engineering designs on a miniature situation, the knowledge has been developed basically to make the Netherlands remain dry. The models were also built from projects in Weipa, Lagos, Port Harcourt, Bajibo, Bangkok, Thyborøn, Abidjan and Licata. Commissioned by these authorities, many coasts and river systems were recreated on a small scale in the Noordoostpolder to make the Dutch engineers test the behaviour of water and the impact of ports and other specific hydraulic infrastructures on it.

The park is owned by the Natuurmonumenten, a Dutch nature conservation program founded by Johannes Theodoor Thijsse who was the father of Jac Pieter; the latter dedicated his entire life to the creation of the Waterloopbos. It was the Dutch Nobel Prize winner H.A. Lorentz (1854-1928) also J.T. Thijsse's teacher, who broke through this way of working with fundamental, theoretical research into fluid mechanics. Johannes Theodoor worked on the closure of the Zuiderzee when to determine water levels and wave heights one had to 'fantasize'; in contrast, working with scale models was a way to empirically observe how water works. A start had already been made on this renovated approach in Germany, Austria and Sweden; in Delft they started testing in 1927 in the basement of the Civil Engineering faculty. Thijsse, a professor at the Technical University Delft, was given larger and larger assignments that no longer fit in the basement.

In 1939, an order from the Stormflood Committee was established to look into the safety of Zeeland: there was the necessity to search for another test location. The Voorsterbos near Kraggenburg (an old island with a lighthouse) in the new Noordoostpolder, after scouting sixteen locations, turned out to be the most appropriate. The land was not usable for agriculture, had soil that was watertight, and the location could intake and discharge water – by natural flow – from the Vollenhover Canal to the Zwolse Vaart. In 1951, two years before the big flood disaster in the North Sea, engineers started building the first model of what would eventually become the Oosterscheldekering. What follows is a rich history of hydraulics: the construction of each new model is a new step in knowledge development.

MISSISSIPPI RIVER BASIN

Also in the United States – in the 1940s – a physical reproduction of the Mississippi River basin was envisaged to empirically observe the reaction of possible control mea-

Mississippi Basin Model (vertical scale 1:100; horizontal scale 1:2000)
looking upstream on the Ohio River from Evansville.
In foreground the Kentucky and Barkley Dams (early 1970s).
Source: US Army Corps of Engineers.

sures on the riverine system. Here, only after the Great Flood of 1927, a new awareness started, and laid the basis for developing experimental scientific tools.
The Mississippi watershed is the third largest river basin in the world after the ones of the Amazon and the Congo and occupies more than forty percent of the United States continental surface: from Canada to Mexico, from the Rocky Mountains to the Appalachians. It is one of the most engineered rivers on the planet: its beds, meanders, banks, and natural dynamics have been constantly modified to control water movements. Since the 17th century, a series of levees, gates, dams, canals, jetties have been created to prevent nearby territories from floods.

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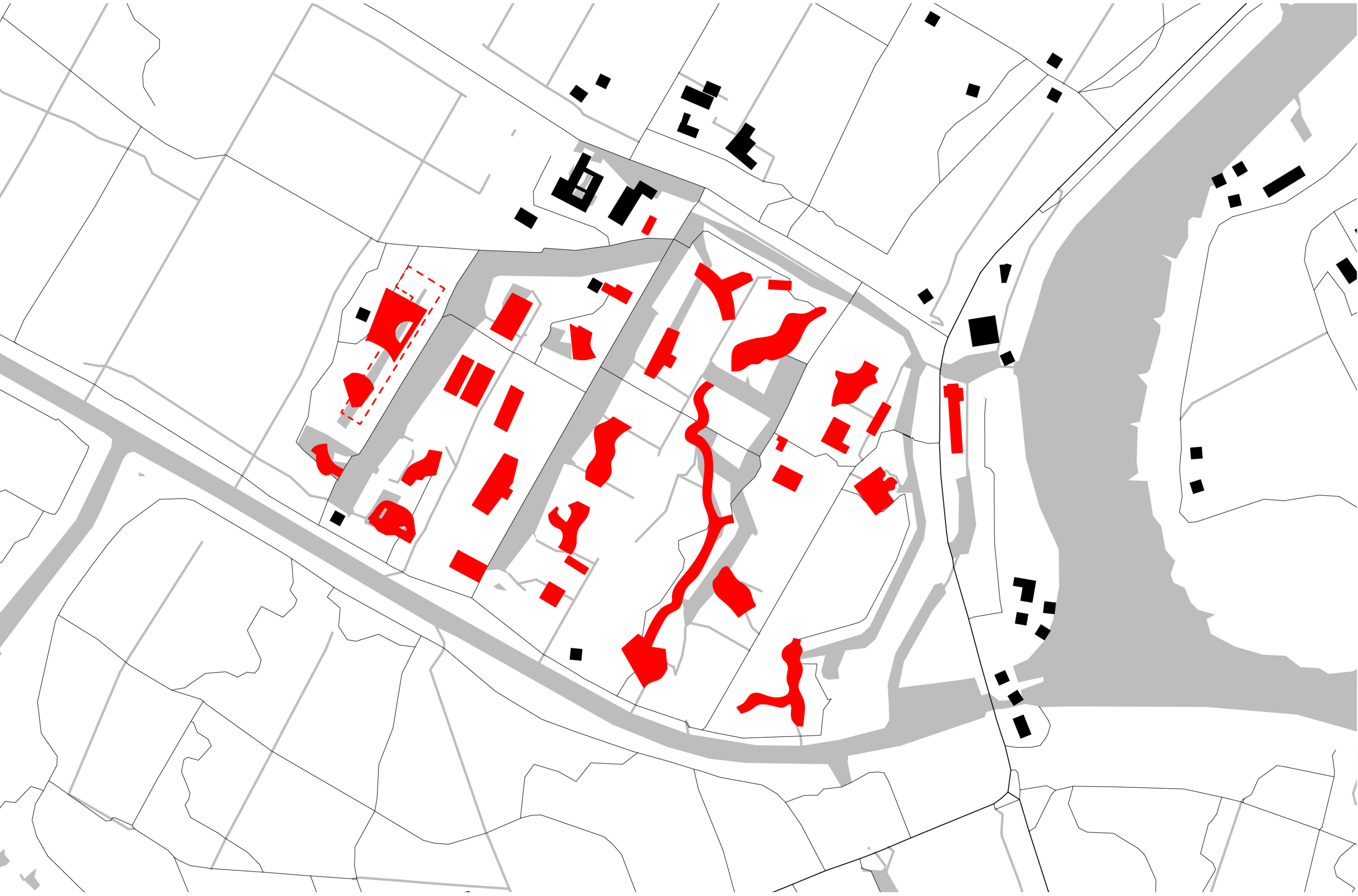
The Mississippi River has also been the object of many historic explorations; early surveyors' maps highlighted the complexity of the flows of the river and the perpetually changing landscape of its tributaries. In the second half of the 19th century, the first scientific study on the river was published. The "Delta Survey" (1861) aimed to decode the governing rules of the river with the aim of understanding its internal dynamics, expressing them into specific formulae and then applying these for functional operations. After the Report, in 1879, the Mississippi River Commission was authorized by the U.S. Congress to carry out technical experiments and improvement plans in order to reduce extreme flooding: the river became part of the race to modernity by stabilizing the banks, dredging the beds, developing navigability, channelling for agriculture (Mathur, Da Cunha, 2001: 18).

In 1927 the Great Flood hit the hundreds of miles of levees that had previously been built to protect against flooding; it constrained the Mississippi river to the point where the system collapsed: water inundated more than twenty thousand square miles of valleys. The disaster laid the basis for a new approach to river management: the need for more space for water and plains was evident. The "Project Flood" – as part of the Flood Control Act (1936) – was initiated; the project aimed to create more room for the river by building knowledge of the "dynamic system of interconnected waterways" (Cheramie, 2011). Innovative typologies of dikes, spillways, safety valves and also new

Waterloopbos
Photography by Luca Iuorio

Mississippi River Basin Model
Photography by Baukje Kothuis



Waterloopbos
Plan. Scale 1:8000

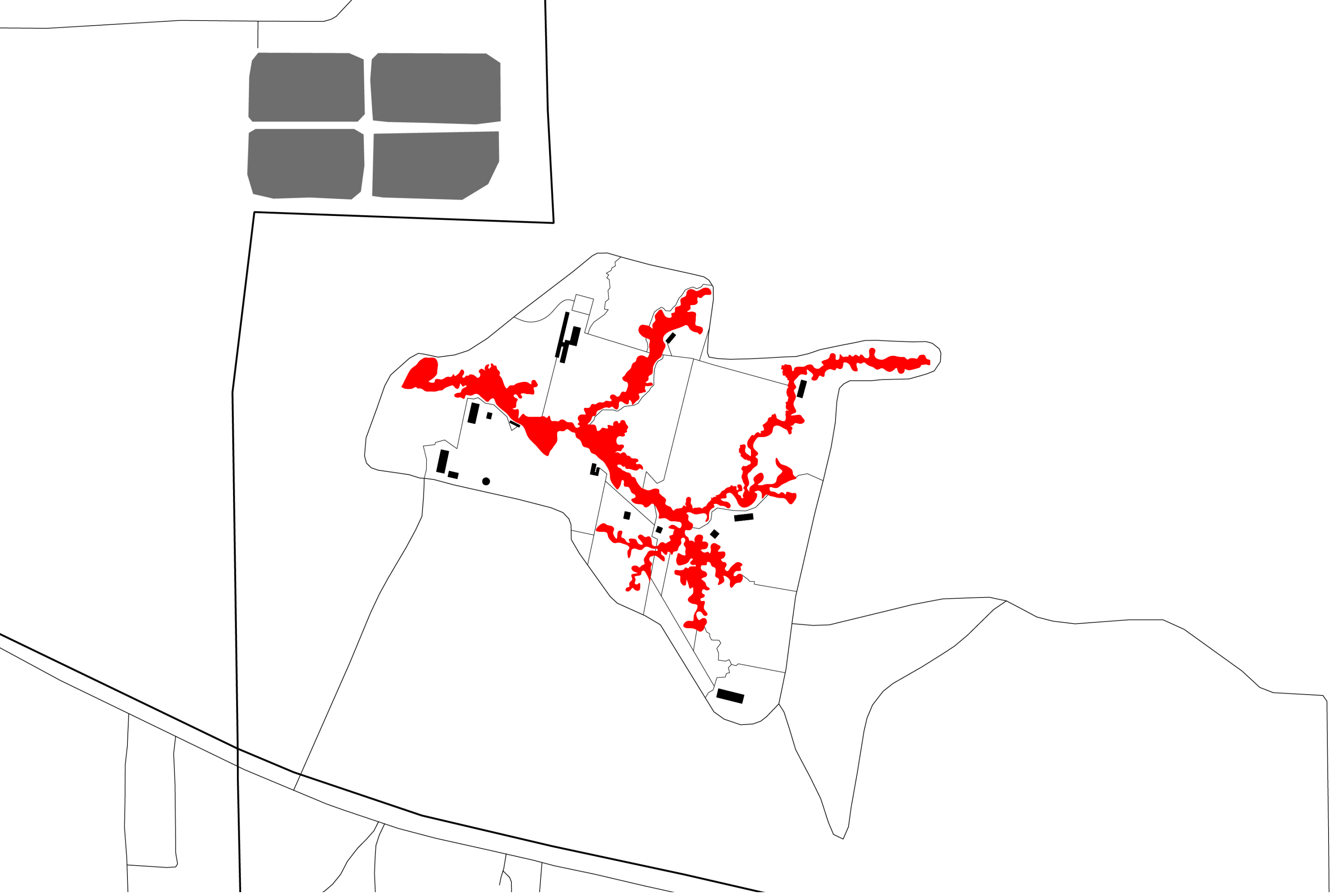
research tools were needed. During the 1940s, indeed, the Army Corporation of Engineers established the Mississippi Basin Model. It was built in Clinton, Mississippi; German prisoners of war deployed to move more than a billion cubic yards of earth to shape the river's geomorphology to scale: its tributaries, branches, channels, and bridges. In 1952, the Missouri River branch was operational and in use; in 1959, the entire model was completed, and the overall testing started. The engineers conducted trials to monitor and precast water levels and safety levels in the Mississippi basin for the purpose of further engineering projects, such as dams, flumes, pumps and reservoirs (Usace, 1971).

OUT OF ORDER: TWO PAIN POINTS

The Waterloopbos operated as a water laboratory for Dutch engineers until the 1990s; the Mississippi Basin Model was last used in the 1970s when a flood occurred in the Lower Mississippi and final empirical tests were done. Today, both are abandoned due to the digital modelling outbreak.

In the mid-20th century, the construction of these two waterwork laboratories reflect a renewed need to approach hydraulic engineering by empirical experimentation; they are also the physical outcome of a new sensitivity towards the rivers that could thus be displayed to the public. In 1964, for instance, guided tours started in the Mississippi model; even an observation tower and elevated platforms were added to the site for reasons of tourist accessibility. In 2017, Ronald and Erik Rietveld with Atelier de Lyon transformed the 1977 model for the Delta Works into a monument to commemorate the long-lasting battle of the Dutch people against water. The Waterloopbos and the Mississippi Basin Model not only have been hydraulic experimental stations but also means of propaganda of the engineers' grandeur: their ability to understand nature and therefore take control of it (McPhee, 1989). A 1948 article defined the Mississippi model as a "colossal effigy of Old Man River [that] will make little floods to help America protect herself against big ones" (Popular Science, 1948: 115). They were, for the Netherlands and for the United States, parts of a larger narrative of the modernistic technological enthusiasm that characterized the western world's relations with nature especially during the last 20th century.

Furthermore, these two stories – perhaps unintentionally – expose two pain points of our current time. Firstly, the fact that there is now a much larger gap between academics and practice than then. As Han Vrijling, emeritus professor of TU Delft in Hydraulic engineering, once explained that he was taught by people such as Thijsse who introduced the anecdotes of what went right and what went wrong in practice; the next generation of professors soon became managers and with that education lost the wisdom of the cold ground.

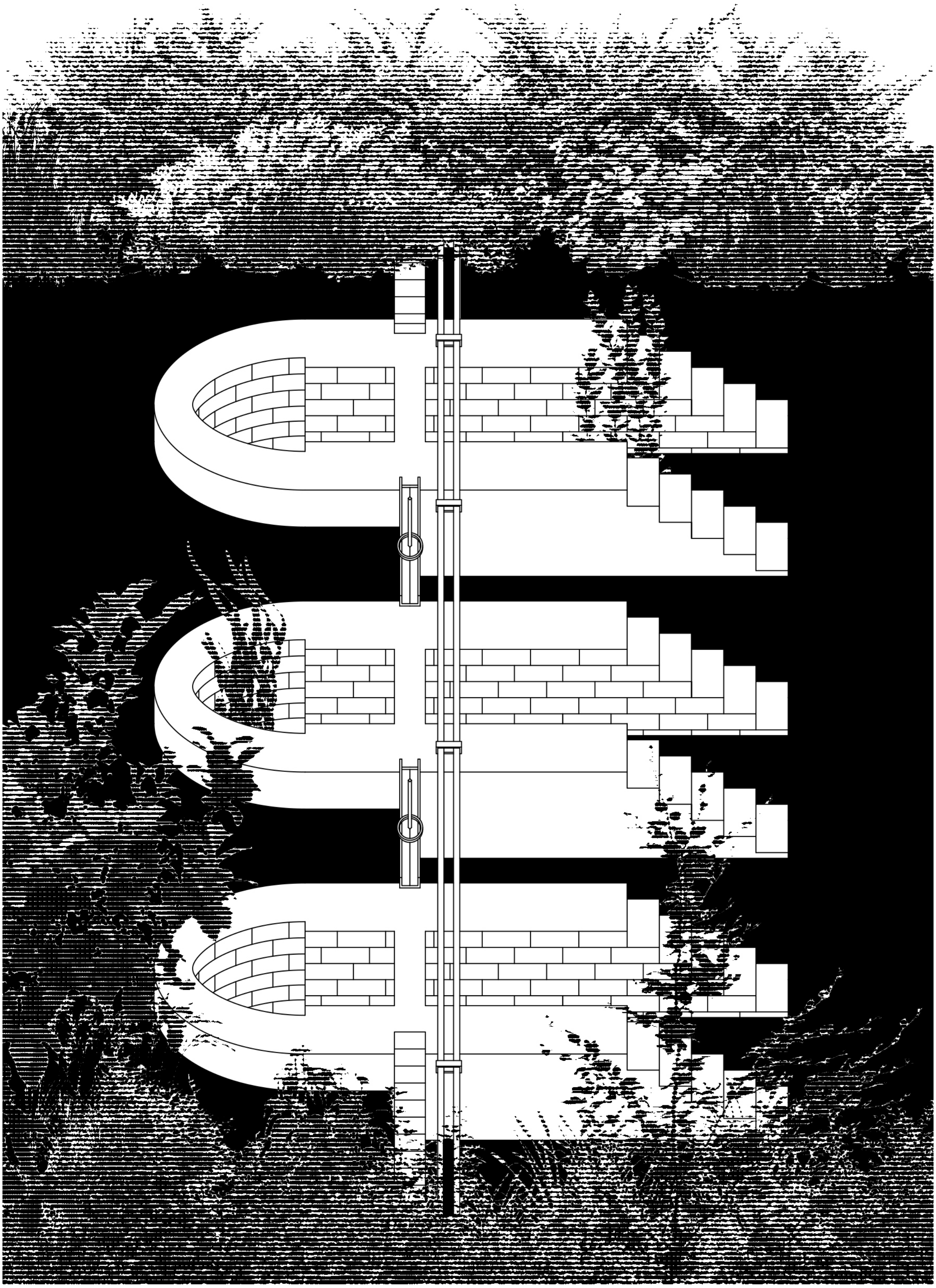


Mississippi Basin Model
Plan. Scale 1:8000

This leads to the next pain point: the art of engineering has to change. A Dutch dijkgraaf (Dike count) traditionally prays: ‘Lord give us daily bread and the occasional flood’. He prays to legitimize his problem. Unfortunately, we have become too used to technical solutions to take natural disasters seriously.

The natural system must again be looked at more closely and then the application of technical interventions must be geared to it. This is already happening on a realistic scale (with the numerous development of marshlands and wetlands, reconstruction of dunes, experimental typologies of dikes, the Sand Motor on the Delfland coast, and many demolitions of dams in the US), but a new watercourse forest in which technical solutions that better relate to natural disasters, as envisaged in the Building with Nature concept, would certainly not be a superfluous luxury.

The designers of the artwork that was made out of the big flume in the Waterloopbos call their approach Hardcore Heritage. It opposes the simple preservation of monuments and sees their work as a cultural experiment. The Deltawerk 1:1 is a manifesto that is represented by the deconstruction of the flume and the radical change of the context, i.e. the excavation. The manifesto deals with the field of tension between past, present and future and asks: “what the Delta Works of the future should be?” Because the Delta Works of the past may turn out to be worthless due to climate change and new works of art will be needed. Keeping the gutter as a monument will not give it new meaning. The redesign not only gives a spatially new experience of concrete, light, shadow, water and reflection but also a new meaning because the concrete will be overgrown by nature – and it is currently happening in both the Waterloopbos and the Mississippi Basin Model. Nature is the Longue Duree and in creating a sustainable future the design of Deltas need to take this as a fundamental starting point.



Brick structures, Waterloopbos, 2021.

The figure shows the current status of a series of gates used during the last century to perform hydraulic experiments in the Waterloopbos. These structures – built with bricks – were parts of a complex system to divert water in the models' channels and study the impact of flows on specific engineering constructions. Both, water and bricks recall a long-lasting Dutch imaginary; the word brick(e) itself has Middle Dutch origin. Water and bricks are the elemental materials the urbanscape in the Netherlands has been shaped with; in the axonometric projection, they materialize – blended with nature – as the extant outcome of an outdated engineering attitude of doing hydraulic tests with physical models.

Cement dynamics, Mississippi Basin Model, 2021.

The figure shows the current status of a river branch of the Mississippi Basin Model. Here, tests were executed by hydraulic engineers to study the effects of the potential construction of dams, reservoirs, and levees on the larger inhabited territory. The morphology of the watershed was molded in detail in order to recreate the paleo-dynamics of the river water flows. But the cement panels of the model were a fixed impermeable surface that didn't meet the complexity of mixed earth, clay, rocks, sand of the original riverbanks. The engineers, then, resolved the issue adding, to the riverbeds, a series of metal plugs and, to the banks, rows of metal folded screens to simulate vegetation. Today, as shown in the axonometric projection, nature is taking its space creating – by contrast – living organic dynamics.

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