Zeeland Earthworks

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[Materialism]:
the theory or belief that nothing exists except matter and its movements and modifications.

[New materialism]:
a theoretical turn away from the persistent dualisms in modern and humanist traditions whose influences are present in much of cultural theory. It seeks a repositioning of the human among non-human actants, questions the stability of an individuated, liberal subject, and advocates a critical materialist attention to the global, distributed influences of late capitalism and climate change.
The North Sea Perspective
Flood Risk

Areas at risk of flooding by rivers and the North Sea in the case of 5m relative sea level rise.
North Sea Perspective
Industrial Coastlines, Ecological Exclusion

Port of Rotterdam

High biodiversity area
High environmental degradation
Ecological Analysis of the Schelde
Material as a Strategy
Earthworks: A Peformative Landscape
Earthworks: A Performativ Facade
Ripple Effects in a Wider System
Ecological analysis
Schelde Estuary, Zeeland, NL
Fewer assets are at risk but an increasingly fortified and inflexible infrastructure is required to protect them. Being the only tidal inlet in the Southwest Delta the Western Scheldt is the most exposed to storm surges and sea level rise. If the primary dikes and dunes do not withstand a storm surge 90% of the land would flood.

Given these circumstances the coastline should be designed to provide storm water retention areas which allow for adaptation to changing physical and economic pressures.

“Every Euro can only be spent once, so investments are the most effective if they are targeted at the weakest flood defence structures that protect large population centres.”

Rijkswaterstaat, Dutch Safety Map (2014)
We ought to consider returning some land to the sea. This could be done by increasing the area of foreshore flooded by the tide.

This would have several major advantages:
With an enlarged estuary, more water would enter on each tide, therefore ebb and flow velocities would be high enough to maintain channel depth partly by natural scour and less dredging would be needed.

The risk of a flood caused by the river overtopping its banks would be reduced because mean high water at Antwerp would be lower.

Sites of great ecological value would be created. In the lower Scheldt particularly, the existing tidal freshwater habitats - unique in western Europe - could be expanded significantly.

Prospects for the Scheldt Estuary, Rijkswaterstaat
Tidal Waters Division
Scenario 1: Raise the Dikes

Ecological Analysis
Scenario-based Response

- More Rigid Banks
- Constricted Tidal Flow
- InCREASED TURBIDITY
- Regulated Contamination of North Sea
- Continued Loss of Intertidal Habitats
- Dredging
- Spoils
- Heavy Metal Contamination
Scenario 2: Inundate the Land

- High risk of heavy metal contamination
- Open shoreline
- Increased intertidal habitats
- Regulated contamination of North Sea
- Reduced turbidity
- Reduced dredging
- Spoils
Scenario:

The dominant actor in the Schelde Estuary, the Port of Antwerp continues to expand. According to the Statute of the Western Scheldt dating from 1839, the Netherlands guarantees the necessary works to maintain access to the port, including continued dredging to give access to ever-larger ships.

The port continues to compensate for ecological damage by pushing for the depolderisation of land bordering the Western Scheldt, often in Dutch territory, arguing along three lines: flood defence (through a decrease in tidal height variation at Antwerp); increased intertidal habitats and the reduction in dredging as a result of increased tidal velocities.

However, in a departure from the current model, this compensation fund is imagined to be locally managed by individual communities where they sustain some loss of farmland for their own protection and benefit through a site specific adaptation of the existing dike and polder system.
Strategy

Material Analysis
Material as a Strategy
The Performative Landscape

Dutch landscape painting serves and energises a system of values in which meaning is not 'read' but 'seen,' in which new knowledge is visualized recorded.

Plants have developed complex defenses to resist salt stress that rely on a variety of mechanisms. Induction of these pathways through brief exposure to low levels of salt stress, a process called salt acclimation, can improve a plant's resistance to salinity. Generally, halophytes follow three mechanisms of salt tolerance: reduction of the Na+ influx, compartmentalization, and excretion of sodium ions.
Material as a Strategy
Altered Flows

- HEAVY METAL CONTAMINATION
- RIGID BANKS
- CONSTRICTED TIDAL FLOW
- SPOILS
- DREDGING
- INCREASED TURBIDITY
- HEAVY METAL CONTAMINATION
- REGULATED CONTAMINATION OF NORTH SEA
- LOSS OF INTERTIDAL HABITATS

Copper contamination of the Schelde

0 - 25μg/l
Material as a Strategy
Elements of the Schelde

water
sand
riverine + sea clay
debris
salt
organic matter
crude oil
zinc
copper
cromium
lead
nickel

collect
store
treat
reuse
Ceramic material is proposed for incorporating toxic heavy metals into a solid form resistant to chemical degradation and leaching. In its inert form the pollutants of the Scheldt become both visible and a part of a new local economy, creating a functional landscape which accepts an altered condition.

<table>
<thead>
<tr>
<th>water</th>
<th>sand</th>
<th>riverine + sea clay debris</th>
<th>salt</th>
<th>organic matter</th>
<th>crude oil</th>
<th>zinc</th>
<th>copper</th>
<th>chromium</th>
<th>lead</th>
<th>nickel</th>
</tr>
</thead>
<tbody>
<tr>
<td>collect</td>
<td>store</td>
<td>treat</td>
<td>reuse</td>
<td>clay for ceramics</td>
<td>heavy metal glazes</td>
<td>retention basins</td>
<td>phytoremediation + filtration</td>
<td>land elevation</td>
<td>ceramics production</td>
<td></td>
</tr>
</tbody>
</table>

Agne Kuznienkaite, *Ignorance is Bliss* (2016)
Scenario 3: Controlled Inflow of Elements

Material as a Strategy
Re-composition
Earthworks: A Performative Landscape
Test location: Borssele, Zeeland

+ close to urban centre
+ high flood risk
+ industrial border
+ infrastructural border
+ high monument concentration

Vlissengen  Borssele

URBAN
Historic and economic centre
Westerschelde tunnelweg
Key access route

DIKE RING +7m
Dredged channel -50m

Historic mound
Remains of 11th century castle

CULTURAL
Earthworks: A Performative Landscape
Landscape Typologies Lexicon

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>LAND</th>
<th>WATER</th>
<th>GARDEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERFORM</td>
<td>FIELD</td>
<td>BASIN</td>
<td>LAKE</td>
</tr>
<tr>
<td>PROTECT</td>
<td>DIKE</td>
<td>CHANNEL</td>
<td>WALL</td>
</tr>
<tr>
<td>INHABITAT</td>
<td>MOUND</td>
<td>ISLAND</td>
<td>HOUSE</td>
</tr>
</tbody>
</table>
### Earthworks: A Performative Landscape

#### Landscape typologies lexicon

<table>
<thead>
<tr>
<th>Sediment Type</th>
<th>Size Range</th>
<th>Sedimentation Rate</th>
<th>Settles 1.7m</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Sand</td>
<td>0.004-0.25mm</td>
<td>0.00000001-0.0005 ft/s</td>
<td>&gt;170000 hours</td>
<td>Requires coir baffles</td>
</tr>
<tr>
<td>Silt</td>
<td>0.004-0.006mm</td>
<td>0.000001-0.01 ft/s</td>
<td>&gt;170 hours</td>
<td>Requires coir baffles</td>
</tr>
<tr>
<td>Clay</td>
<td>&lt;0.004 mm</td>
<td>&gt;0.0005 ft/s</td>
<td>1 sec</td>
<td>Requires coir baffles, skimmers*</td>
</tr>
<tr>
<td>Gravel</td>
<td>2-4 mm</td>
<td>50-100 ft/s</td>
<td>1 sec</td>
<td>Requires coir baffles, skimmers*</td>
</tr>
<tr>
<td>Sedimentation rate:</td>
<td>0.00000001-0.0005 ft/s</td>
<td>&gt;170000 hours</td>
<td>Requires coir baffles</td>
<td></td>
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</tbody>
</table>

**Notes:**
- *Drainage from top, captures 90% of silt + clay when water is held for 24 hours.
- **Environmentally safe water-soluble polyacrylamide drinking water treatment chemical additive, 1.5l/3000l water.

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**Proposed Garden**

**Proposed Town**

**Excavation Process**

**Existing Landscape**
Historic creek beds

Historic and economic centre

Remains of 11th century castle

Historic mound

Westerschelde tunnelweg

Key access route

URBAN

CULTURAL

Dike ring +7m

Dredged channel -50m

Earthworks: A Performative Landscape

Landscape System

Earthworks: A Performative Landscape

Landscape System
Earthworks: A Performative Landscape
Landscape System: Tidal Inlet
Earthworks: A Performative Landscape
Retaining Wall, Material Collection
Earthworks: A Performative Landscape
Earthworks Factory Exhibition
Earthworks: A Performative Landscape
Walkway Across the Dike
Earthworks: A Performative Facade
Programme of requirements based on material elements of Schelde

**sediment volume inflow/tide**
- area of basins: 500,000m²
- water depth: 1.7m
- volume water inflow: 850,000,000l
- approx 350mg suspended sediment / l
- sediment volume: 350m³
- approx clay composition 10%
- clay volume: 30m³
- clay weight: 30 tonnes
- silo 5x6x6m volume: 180m³
- clay curing 2 months
- 9 silos for storage of clay

A Biomass storage
3 Biomass
Tools, vehicle storage

B Glass production lab
1 Soil researcher, artist

C Biomass burner

D Phytoremediation gardens

E Storage silos
125m³

F Clay milling
5 Controllers

G Clay mixing
3 Controllers

H Extrusion and printing

I Drying space
2 Controllers

J Kiln
2 Controllers

K Storage and distribution
5 Drivers

L Exhibition
3 Artists in residence, 1 curator

M WCs

N Print design labs
2 Permanent technicians

O Kitchen + dining
5 Staff

P Distribution by barge
1 Hydrologist, 2 crew
28 Permanent staff
Earthworks: A Performative Facade
Building as a Membrane

- Production - material flows
- Clay collection, transformation, distribution

- Protection - water flows
- Storm surge storage

- Wetland creation
Earthworks: A Performative Facade
Building as a Membrane
Earthworks: A Performative Facade
A Performative Wall: Protective and Productive Facade Seen from the Scheldt
Earthworks: A Performative Facade
A Performative Wall: Deep Active Facade, Controlling the Flow of Water and Clay
Earthworks: A Performative Facade

A Performative Wall: Machine Hall and Drying Basin, Oriented to the Flow of Air
Earthworks: A Performative Facade
A Performative Wall: Landscape Length Facade, Open Towards the Transforming Polderscape
Earthworks: A Performative Facade
A Performative Wall: Landscape Length Facade, Open Towards the Transforming Polderscape
a) angled to orientated pumps to collect sediment from the incoming flow into the basin

b) holds industrial chimneys to ventilate and cool machinery

c) holds sluice gates to drain basin

d) corrugated form creates stiffness to withstand hydrostatic force
Ripple Effects in a Wider System
A New Horizon Line
Ripple Effects in a Wider System
New Landscape Conditions
Ripple Effects in a Wider System

New Landscape Conditions
Ripple Effects in a Wider System
New Landscape Conditions