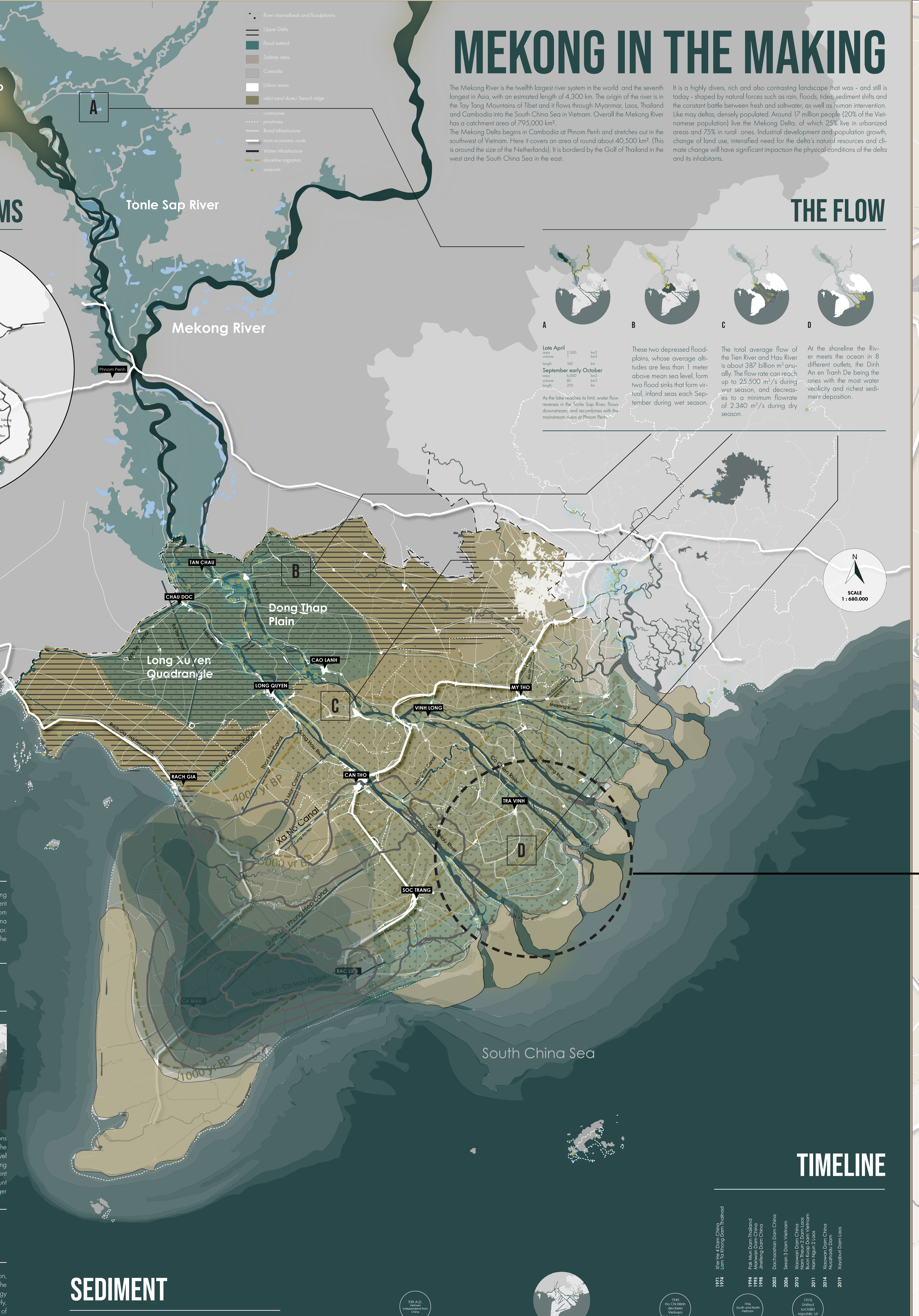
MEKONG IN THE MAKING

The Mekong River is the twelfth largest river system in the world and the seventh longest in Asia, with an esimated length of 4,300 km. The origin of the river is in the Tay Tang Mountains of Tibet and it flows through Myanmar, Laos, Thailand and Cambodia into the South China Sea in Vietnam. Overall the Mekong River has a catchment area of 795,000 km².
The Mekong Delta begins in Cambodia at Phnom Penh and stretches out in the southwest of Vietnam. Here it covers an area of round about 40,500 km². (This is around the size of the Netherlands). It is borderd by the Golf of Thailand in the west and the South China Sea in the east.

It is a highly divers, rich and also contrasting landscape that was - and still is today - shaped by natural forces such as rain, floods, tides, sediment shifts and the constant battle between fresh and saltwater, as well as human intervention. Like may deltas, densely populated. Around 17 million people (20% of the Vietnamese population) live the Mekong Delta, of which 25% live in urbanized areas and 75% in rural ones. Industrial development and population growth, change of land use, intensified need for the delta's natural resources and climate change will have significant impactson the physical conditions of the delta and its inhabitants.



MAIN RIVER DAMS

THE FLOW

A

Late April

area	2,500	km2
volume	1	km3
length	160	km

September early October

area	6,000	km2
volume	80	km3
length	250	km

As the lake reaches its limit, water flow reverses in the Tonle Sap River, flows downstream, and recombines with the mainstream rivers at Phnom Penh.

B

These two depressed floodplains, whose average altitudes are less than 1 meter above mean sea level, form two flood sinks that form virtual, inland seas each September during wet season.

C

The total average flow of the Tien River and Hau River is about 387 billion m^3 anually. The flow rate can reach up to 25.500 m^3/s during wet season, and decreases to a minimum flowrate of 2.340 m^3/s during dry season.

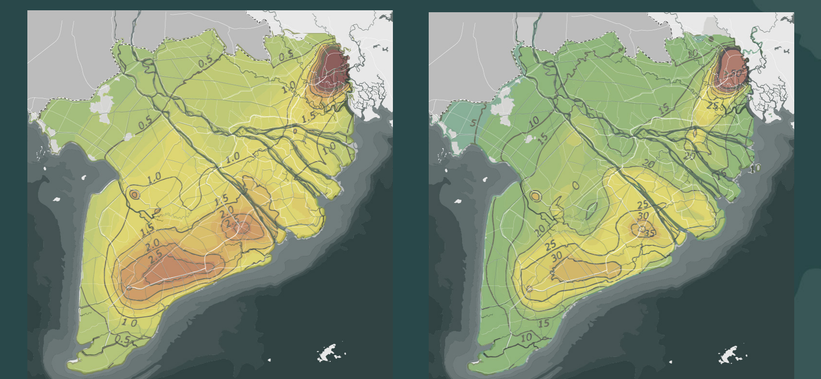
D

At the shoreline the River meets the ocean in 8 different outlets, the Dinh An en Tranh De being the ones with the most water veolicity and richest sediment deposition.

EROSION

Researchers monitoring the Mekong say a crisis that has been building on the river for years has turned into a full-blown emergency in recent months. They blame two man-made phenomena: the mining of sand from the riverbed and the building of new dams upriver in Laos and China that are altering the river's flow, sediment content and even its color. Two decades ago, the delta was still gaining land from the sea. Now the region is losing as much as 12 meters of its coast in some places.

LAND SUBSIDENCE

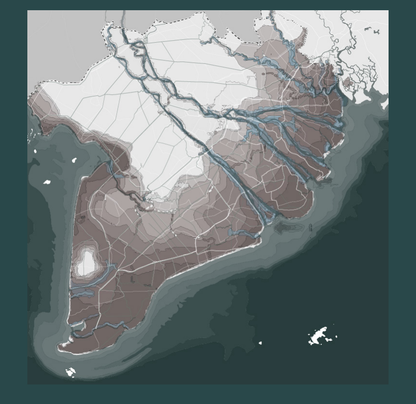


With the rising demand for fresh water, predominantly on the outer regions of the Delta where salinity is leaving the groundwater undrinkable, the ground is subsiding. With an average altitude of 80cm above sea level it endangers those regions to saltwater floods and making rice farming impossible. The current subsidence rate is 3cm/year. Dam development in the Mekong may also potentially cause major changes in the amount of sediment transported to the delta and land subsidence is not longer counterbalanced by sedimentation.

RISING SEALEVEL

A recent paper published by Climate Central, a non-profit organization, briefly made a splash in Vietnam when it forecast that by 2050 most of the delta would be submerged. However, some questioned the methodology used in the forecast, and researchers say the sea level is rising slowly, for now, at about 3mm a year. With the deltas average altitude of around 80cm above sea level this is nonetheless an existential threat.

SALINITY



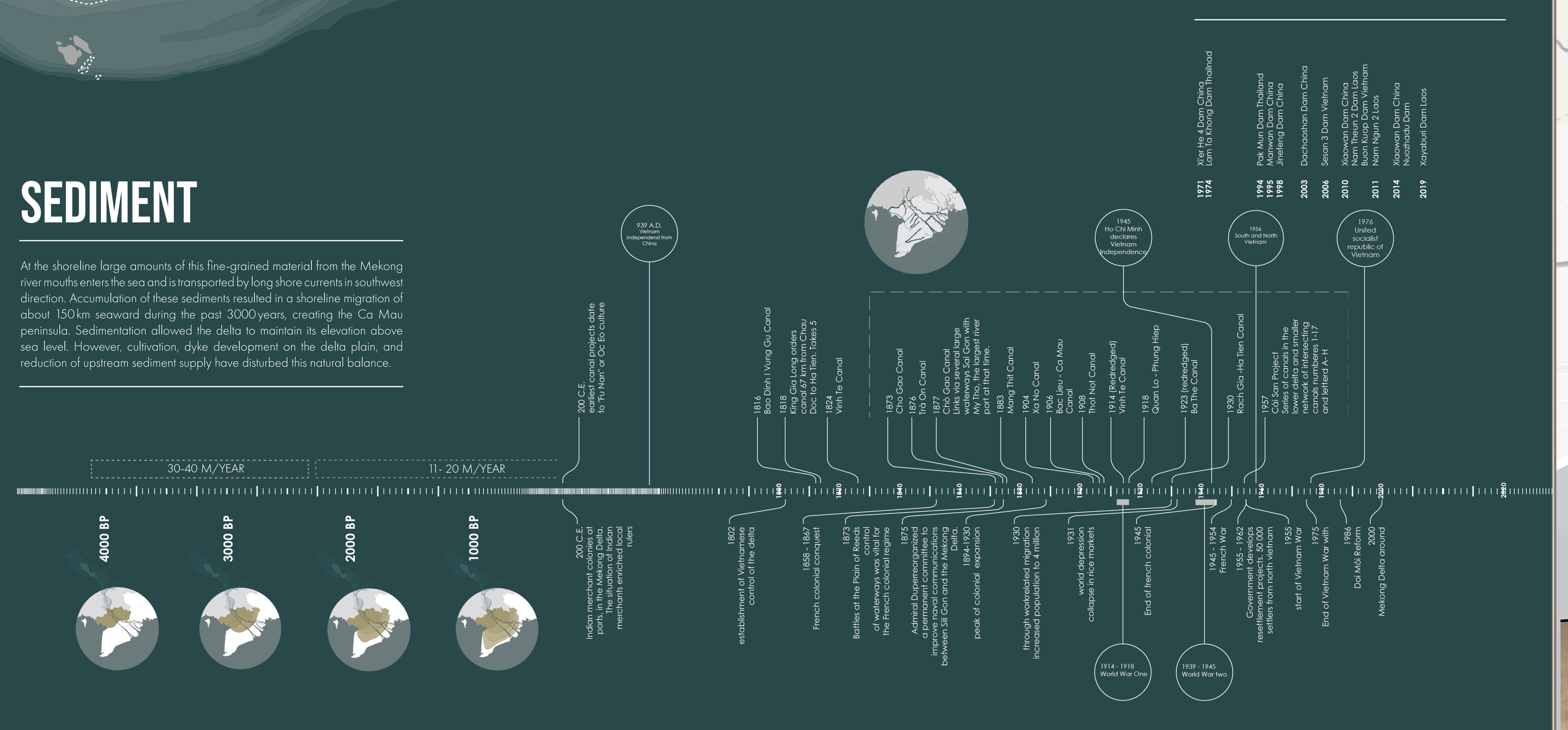
Higher water and sinking land are causing more salt water to intrude, upsetting the balance of fresh water, salt water and brackish water on which the delta's rice, fruit and shrimp farmers rely.

According to recent data, salinity intrusion has increased the salt content of water in the delta's intricate system of rivers and irrigation canals. Salinity expanded through the Tien and Hau Rivers by up to 45- 65 km and 55-60 km, respectively, considered to be the most extensive salinity intrusion in the last 90 years. The Hau and Tien Rivers, the main source of freshwater in the region, have become unusable as freshwater sources with salinity levels in excess of 5%, way above the usual level of 1-2%. In many areas, people have to drill wells up to 90 meters in depth to get groundwater.

SEDIMENT

At the shoreline large amounts of this fine-grained material from the Mekong river mouths enters the sea and is transported by long shore currents in southwest direction. Accumulation of these sediments resulted in a shoreline migration of about 150 km seaward during the past 3000 years, creating the Ca Mau peninsula. Sedimentation allowed the delta to maintain its elevation above sea level. However, cultivation, dyke development on the delta plain, and reduction of upstream sediment supply have disturbed this natural balance.

TIMELINE



ADAPTING VS. CONTROLLING

The Mekong delta is an example. A perfect example of how humanity has over exploited its natural recources. We have a long ongoing history of trying to make nature suit us best and supply for our every need and desire, only to now stand at the bottom of pile of problems we partly created or emensly supported in creating during our greedy and comfortable little journey on this planet so far. The enviromental challenges facing the Mekong Delta are largely manmade problems born in a time of control oriented ideologies. Local knowledge of adapting and living with the enviorment were drowned out in a fight for power and riches.

One means of making these problems "unmade" is to assess past resource development strategies in a more critical historical perspective that pays closer attention to alternative approaches and local traditions for managing water resources. That being said, it is time to open up the dams, or at the very least stop building new ones. There is no need for a shopping mall to have 500 stores and a ferries wheel in Bangkok while locals starve and watch their houses crach into the waves.

Opportunity
adjusting to the enviroment

v.s.

Hindrance
controlling the enviroment

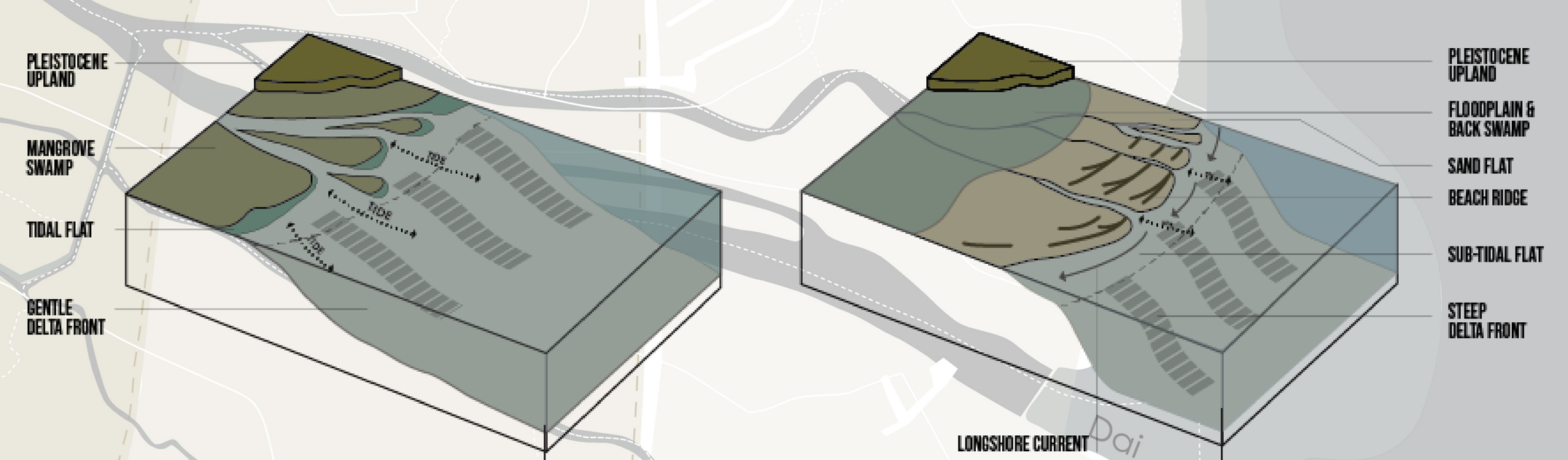
THE GROW

Most of the present Mekong delta plain in Vietnam was shallow sea. Then the delta prograded southeast, toward the South China Sea with an average rate of 10–16 km2/yr. The mean tidal range is 2.5 ± 0.1 m, and the maximum tidal range is 3.2–3.8 m.
The delta system can be classified into flood plain and strand plain, with mangrove swamp along the shore. The strand plain is characterized by rows of beach ridges, trending northeast to southwest and 3m to 10m in height, and inter-ridge swamps. The beach ridges often have a diverging, bifurcating pattern formed by southwestward spit progradation. The modern active coastal environment is divided into mangroves, beach ridges, sand flats (foreshore) in the upper part of intertidal zone, intertidal to subtidal flat, delta front, and prodelta. The water depth of the boundary between the subtidal flat and the delta front is about 10 m.

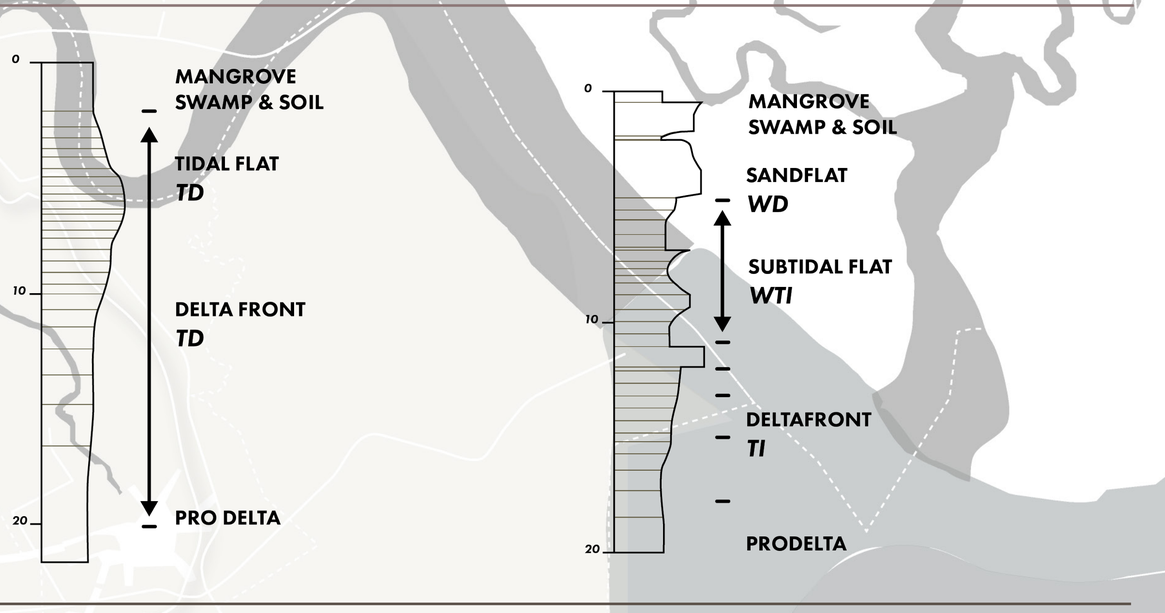
„Delta evolution model inferred from the holocene mekong delta, southern vietnam", Susumu Tanabe, Thi Kim Oanh Ta, Van Lap Nguyen, Masaaki Tateishi, Iowa Kobayashi, Yoshiki Saito, Japan, 2014

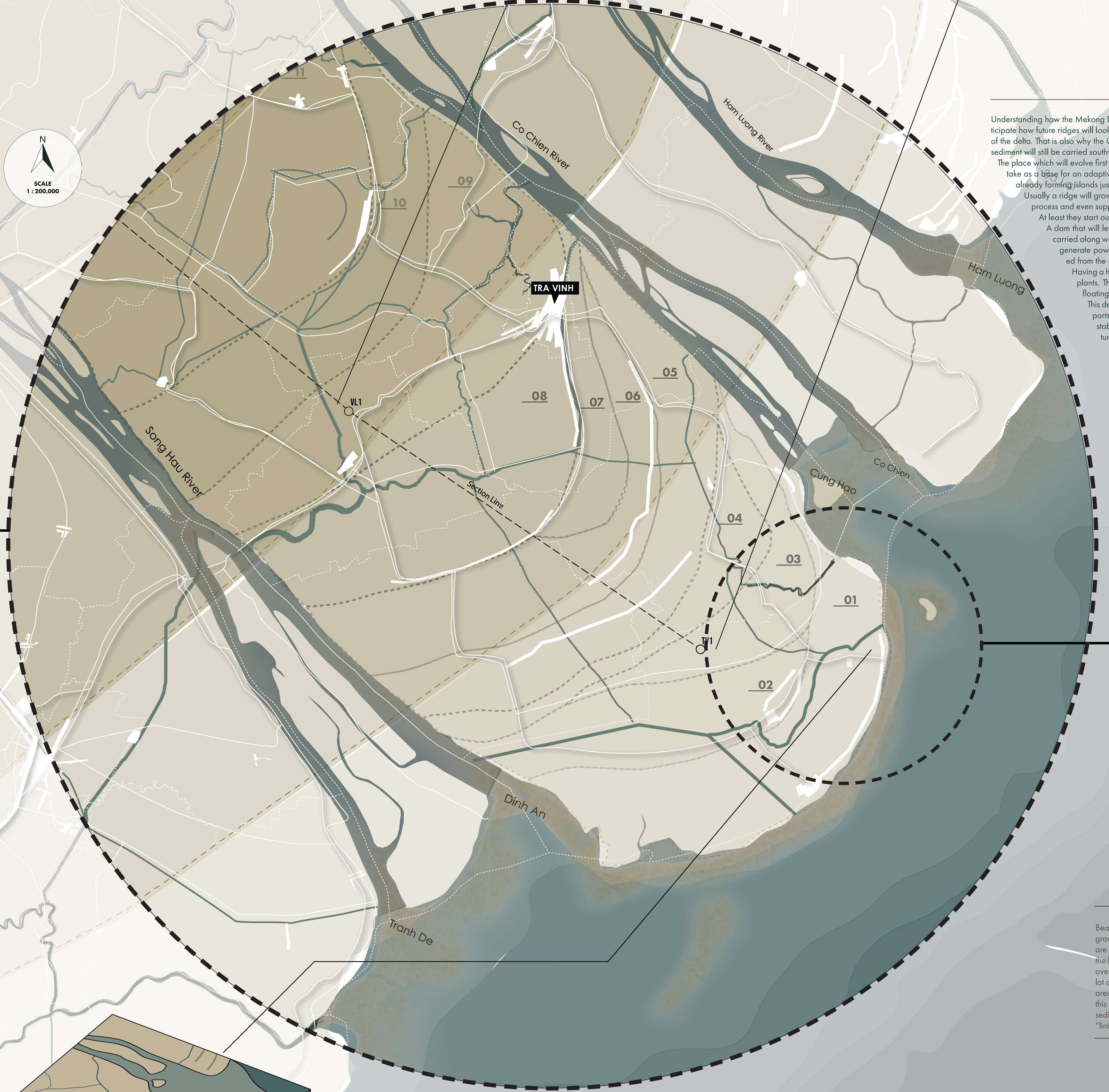
VL1 stage (6000 - 2500 cal. yr BP)

TV1 stage (2500 - 0 cal. yr BP)



RIDGESECTION





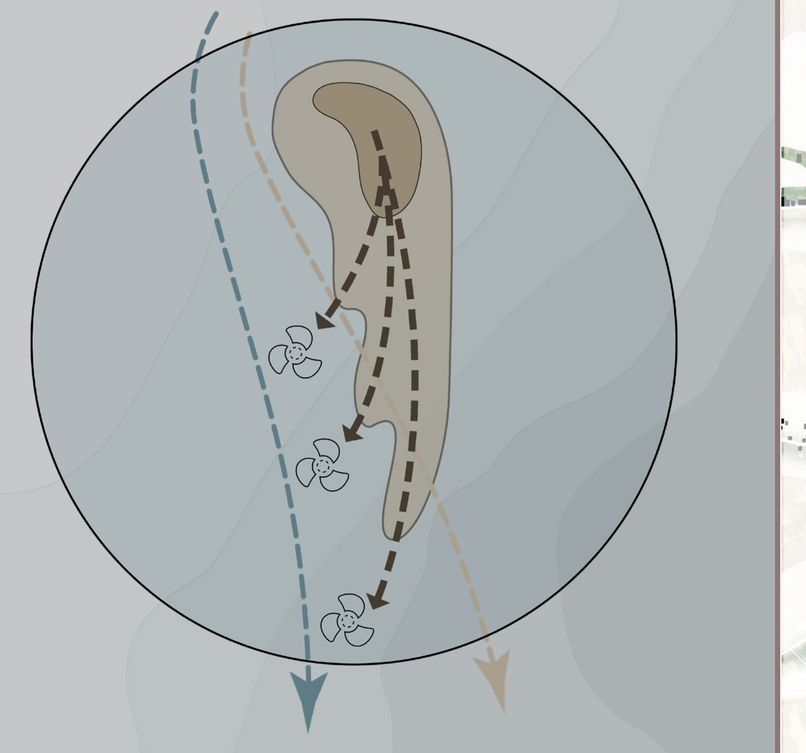
DESIGN STRATEGY

Understanding how the Mekong Delta grew over the last 4000 years is important in trying to anticipate how future ridges will look like. The long shore current is a key element for the progression of the delta. That is also why the Cau Mau Peninsula will most likely not sink into the ocean, since sediment will still be carried southwest wards.

The place which will evolve first in the future, and is therefore the location to further research and take as a base for an adaptive design, is the Co Chien River Bay. Here sattelite images show already forming islands just poking out the water surface.

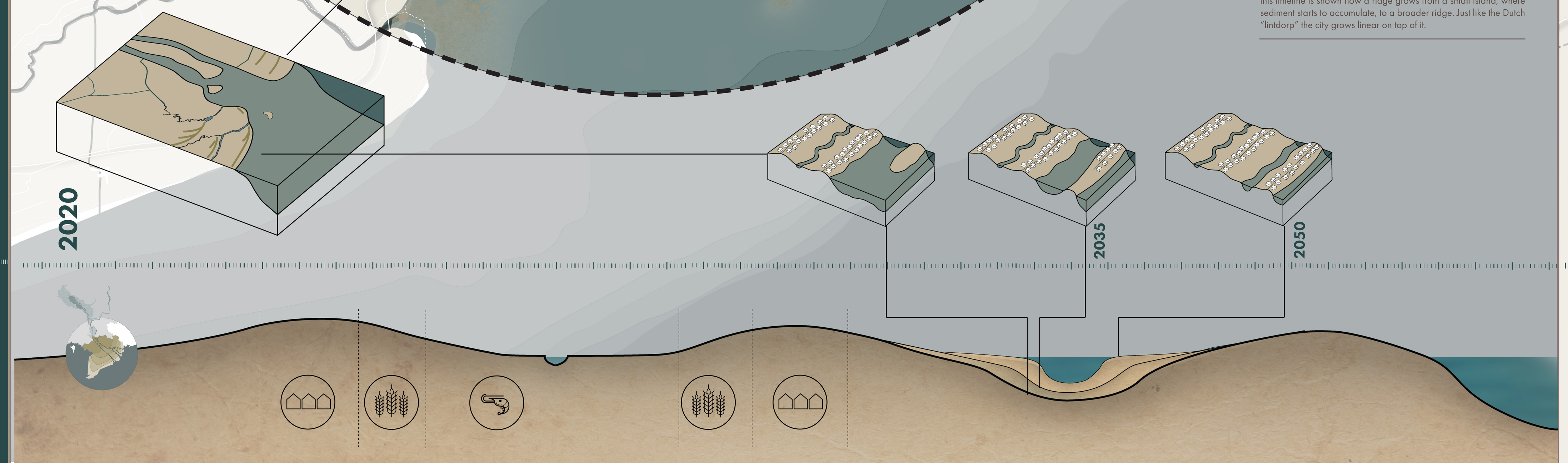
Usually a ridge will grow and then the city on top of it. But there is a way to combine this process and even support it. The streets of the upcoming urban area are actually piers. At least they start out as such. On the little island the first semipermeable dam is built. A dam that will let water through, but helps with the accumulation of the sediment carried along with it. This way the land can fill up further while the ends of the pier generate power for the prograting city. Since we take away power generated from the dams upstream, a sustainable energy source is to be integrated. Having a high tidal range makes it the perfect spot to implement tidal power plants. These also have to be able to progress with the ridge, therefore floating devices are the best option.

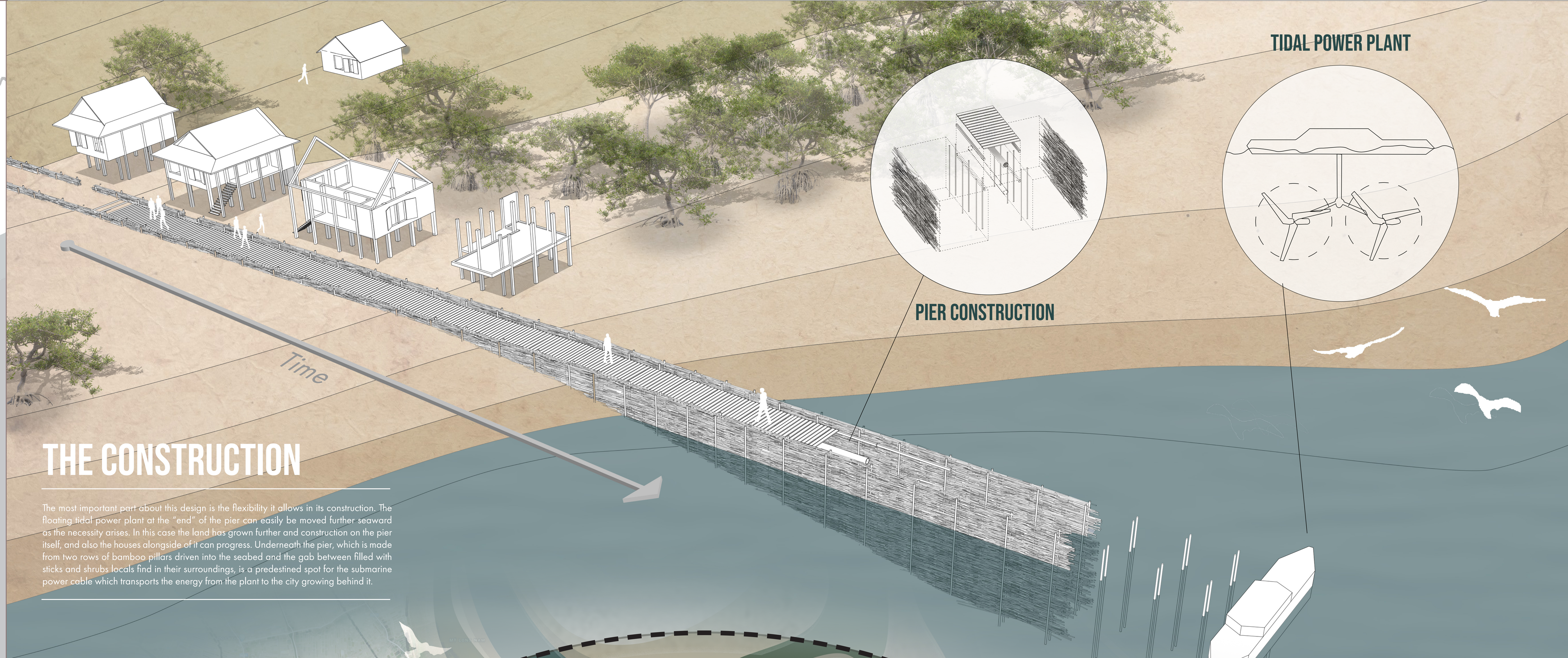
This design therefore adapts to various environmental conditions. It supports sediment accumulation, letting land grow faster and holds its stabilizing function later on. It also emediatly functions as infrastructure for future settlers, and it generates power from tidal variations.



URBANIZATION

Beachridges are a favorable place for urbanization. It is higher ground, making it relatively safe from flooding and erosion. Houses are located perpendicular to the main street, which often indicates the highest grade of the ridge. In between two ridges often lies a "left over" river that marks the lowest point. close to it there is usually a lot of aquaculture in form of shrimp-farming. Closer to the urbanized area the ground is still high enough to use as agriculture farmland. In this timeline is shown how a ridge grows from a small island, where sediment starts to accumulate, to a broader ridge. Just like the Dutch "lintdorp" the city grows linear on top of it.





THE CONSTRUCTION

The most important part about this design is the flexibility it allows in its construction. The floating tidal power plant at the "end" of the pier can easily be moved further seaward as the necessity arises. In this case the land has grown further and construction on the pier itself, and also the houses alongside of it can progress. Underneath the pier, which is made from two rows of bamboo pillars driven into the seabed and the gab between filled with sticks and shrubs locals find in their surroundings, is a predestined spot for the submarine power cable which transports the energy from the plant to the city growing behind it.

RIDGE CITY

Over the course of time the new ridge will have left the ocean as a small river between todays shoreline and the little island it once was. As the land grew so did the city. A city that is self sustainable in its energy demand. A city that used local, renewable materials to support a natural process. And a city that already has a strategy at hand to expand. To grow and adapt.

There is still room for further research how agriculutre and aquacutlure as two of the main sources of income for locals would also evolve with the ridge. How can the tidal energy that is being produced distributed and also stored the most efficient way? How would the city itself be organized along the pier? Schools, shops and every other instance provided for its citizens. How wil this growing city be structured internally? And how this system evolve kilometers into the sea from here.