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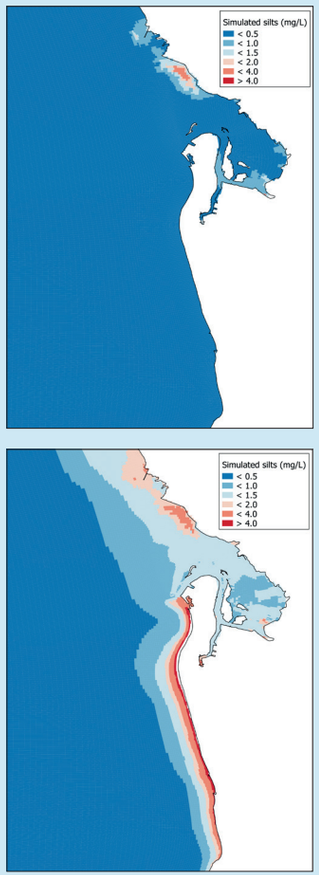
Recovery of Adelaide's seagrass meadows



AREM simulated mean annual concentration of silt particles in 2013, without (above) and with (below) wave-induced sediment resuspension

Seagrass has been disappearing from Adelaide's coastal waters in the Gulf St Vincent, South Australia since the 1950s. The Adelaide Coastal Waters Study concluded in 2007 that the seagrass decline was caused by discharges of treated sewage, rivers and storm water, which reduce water transparency and further the excessive growth of "epiphytes" on the seagrass leaves. Both phenomena reduce the amount of sunlight penetrating to the seagrass leaves and subsequently kill the seagrass. At that time, however, it was not clear when, where, and by how much these discharges would need to be reduced to create the conditions required for recovery of the seagrass meadows..

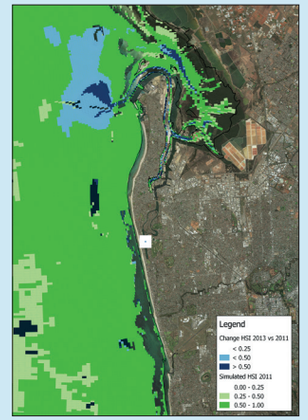
The South Australian Water Corporation (SA Water) provides drinking water and manages wastewater in the Adelaide Metropolitan area. SA Water commissioned Deltares to jointly develop coastal modelling capabilities that would help to answer these questions. With Delft3D as the main "engine", SA Water, Deltares and DAMCO Consulting (Perth, West Australia) built the Adelaide Receiving Environment Model (AREM). The AREM combines information and knowledge embedded in Delft3D about coastal discharges, physical and biogeochemical processes in the coastal waters and the sensitivity of nine different seagrass species occurring in the Adelaide coastal waters to produce suitability maps for seagrasses. SA Water uses AREM to investigate how the condition of seagrasses responds to changes in coastal discharges in terms of timing, location and composition.

The development of AREM was only possible thanks to a substantial effort by SA Water to collect additional data about not only discharge but also the coastal waters. In particular, data quantifying the effect of different substances upon water transparency were important because those substances inhibit the penetration of sunlight to the seagrass leaves. SA Water measured the quantities and concentrations in the coastal waters. This allowed us to validate this part of AREM, which is needed to simulate water quality in the Gulf St Vincent.

Adelaide Metropolitan Area and coastal waters (photo: Paul Erftemeijer, DAMCO Consulting)

Along the way, we learned that it is not just coastal discharges that affect the water quality. There is a very significant "natural" background level of substances that reduce water transparency. Most of the "Coloured Dissolved Organic Matter" in the water enters the coastal zone from the open sea, or it is released directly from seagrass meadows, sediments and mangroves. Likewise, most of the silt particles in the water are released from the seabed by wave stirring. The data and the AREM showed how the "seagrass-sediment-light feedback loop" works: when seagrass disappears, the seafloor is no longer protected from waves and releases silt particles which reduce water transparency and may prevent the seagrass from growing back.

The AREM does not solve the problem but it gives SA Water the best possible understanding of the degree to which proposed interventions can restore seagrass habitat.



AREM simulated habitat suitability for 2011 in green and simulated increase of habitat suitability between 2011 and 2013 due to the cessation of a large industrial discharge in blue