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The morphological development of newly inundated intertidal areas: the mechanisms driving the early evolution of an estuarine environment designed and constructed by humans

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Intertidal saltmarsh and mudflat habitats are of global importance due to the ecosystem, economic and cultural services they provide. These services include wildlife habitat provision and species diversity, immobilisation of pollutants and protection from coastal flooding. Saltmarsh and mudflat environments are, however, being lost and degraded due to erosion caused by rising sea levels and increased storminess. These losses are exacerbated by anthropogenic influences including land reclamation, increased coastal development and the construction of coastal flood defences which prevent the landwards migration of saltmarsh and mudflat environments, resulting in coastal squeeze.

To compensate for saltmarsh and mudflat losses areas of the coastal hinterland are being inundated by breaching defences and constructing new defences inland, thus extending or constructing new estuarine environments; a processes known as de-embankment or managed realignment. Morphological engineering and landscaping within managed realignment sites prior to site inundation varies depending on the aims of the scheme. However, there is a shortage of data on the morphological evolution within these sites post site inundation impeding the ability of coastal engineers to effectively design and construct future sites. To date there has been a focus on the colonisation of marine macro fauna and flora within newly inundated managed realignment sites, which can be relatively rapid and easily quantified. Little is known of the morphological evolution in response to altered sedimentary processes, its driving mechanisms and therefore the success and ecological sustainability of these sites.

This study evaluates the post-inundation morphological development of the largest open coast managed realignment site in Europe, at Medmerry on the south coast of the United Kingdom. Inundated in September 2013, the Medmerry Managed Realignment Site consists of a mosaic of former agricultural land and areas of lower elevation excavated during site construction, drained by a series of natural and engineered channels.

Results indicate different rates and patterns of sedimentation and resulting morphology across the site. Near the breach continuous sedimentation of > 15cm over a 1 year period was measured, compared to rhythmic periods of accretion and erosion inland. These variations have been related to site design, former land-use and different sediment sources. The evolution of developing creek networks, formed by pluvial action and sediment “piping”, are controlled by unconformities found in the sub-surface sediment related to Holocene site evolution. Analysis of the sedimentary processes and subsequent morphological development of these areas provides a new insight into coastal and estuarine evolution in an anthropogenically designed and constructed estuarine environment.