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Analyses of the fluxes of water, sediment, nutrients and metals, after restoration of the tidal regime of a former polder in the River Rhine estuarine, part of The Netherlands.

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A tidal freshwater wetland, the Mariapolder, was restored in the southwestern part of The Netherlands that involved reconnecting the site to the Rhine estuary. Restoration of tidal dynamics has resulted in the establishment of erosion and sedimentation processes, fluxes of nutrients, metals, and other dissolved substances, and plant and animal communities associated with tidal freshwater wetlands. This paper describes the consequences of the 1994 opening of the dike around the Mariapolder, formerly a polder of 25 ha that had been managed as grasslands. Following restoration, the tidal range within the polder has varied between 0.6 and 0.8 m at the inlet and tidal velocity as high as 4 m3/s have been measured at the same site during incoming tides. Within the restored area, tidal water level amplitude has varied between 0.4 and 0.5 m. Automated water level recorders have been used to estimate water fluxes into and from the Mariapolder over 48-hour study periods. From physical and chemical analyses of water collected during the 48-hour periods, balances of suspended sediments, dissolved nutrients, and metals were calculated. There has been a consistent net flux of suspended sediments into the Mariapolder leading to an average raise of 1 - 2 mm/y in surface elevation. The Mariapolder appears to be a net yearly sink for nitrate-nitrogen and a net exporter of some dissolved metals. The mechanisms that control the sink-source dynamics are not yet fully understood and need further investigation. Following restoration, most of the agricultural grassland vegetation has disappeared and pioneer vegetation typical of TFW has developed within the Mariapolder.