# Summary

The Haringvliet Estuary is managed to balance flood safety, freshwater availability and ecological connectivity. Under the Kierbesluit policy, the sluices are partially opened during flood tide to support fish migration. However, saltwater can become trapped in deep areas (bathymetric depressions) and spread towards freshwater intakes. Management therefore requires guidance that accounts for uncertainty in environmental conditions and model predictions.

This EngD project developed a dashboard for saltwater management in the Haringvliet. It combines the existing operational protocol and analytical model with sensitivity and uncertainty analyses, an assessment of vertical mixing (transfer of salt from the lower to the upper water layer) and an iterative stakeholder-centred design process.

The analyses examined how far saltwater travels inland, where it stabilises (its Equilibrium Location), and how much remains after flushing during ebb. Salinity outside the estuary most strongly affected the Equilibrium Location, while the volumes entering during flood and discharged during ebb strongly affected the retained salt mass. The model was modified to represent differences in vertical mixing among bathymetric depressions. This provided a more extensive representation of mixing but did not improve the overall Equilibrium Location prediction. Broader structural model development is required, rather than modifying the mixing formulation alone.

The executable dashboard translates relationships between operating conditions, saltwater location and retained salt mass into uncertainty-aware information. It provides a recommended Inlet volume, the estimated probability of keeping saltwater within a target location, a confidence interval around this probability, operational warnings and a conservative safe recommendation. Users can compare four scenarios and explore changes in discharge, salinity, protocol settings and uncertainty assumptions.

Stakeholder feedback shaped the terminology, input workflow and layered interface. The research prototype supports scenario evaluation, discussion and learning. It has not been validated for real-time operation and is intended to support, rather than replace, expert judgement.