Assessing the efficiency of mitigation measures for saltwater intrusion in man-made canals

A comprehensive modelling study for the Ghent-Terneuzen canal

Tijl Wijnants

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Graduation committee:
University of Twente
dr. ir. B.W. Borsje
ir. R.W.A. Siemes

Affiliation
ir. R.J. Daggenvoorde

The New Lock Terneuzen, currently under construction, is to become one of the largest sea locks worldwide. Its commissioning is anticipated by the end of 2024. As part of the new design, the New Lock Terneuzen will replace the previous middle lock, resulting in a longer, deeper, and wider lock. However, the introduction of the New Lock is expected to lead to increased saltwater intrusion in the canal.

To address the potential adverse effects of saltwater intrusion on local agriculture and industry, a comprehensive study was conducted. Figure 1 illustrates the modifications associated with the new design, comparing the existing scenario with the Middle lock to the new scenario with the New Lock Terneuzen and the existing western lock.

A well-established model for simulating saltwater intrusion was used, which was calibrated and validated for the year 2020, showing good performance in matching observed salinity levels in the canal. Subsequently, the model was adapted to incorporate the New Lock Terneuzen, revealing a significant increase in salt content. This underscores the necessity for mitigation measures to reduce saltwater intrusion as can be seen in figure 2.

Eight mitigation measures were tested, comprising four physical measures (saltwater trap, elevated threshold, canal constriction, and selective withdrawal) and four management measures related to upstream discharge (summer discharge spreading, summer pulses, winter flushing, and a rainfall pulse). The model was employed to simulate and analyze the impact of these measures on saltwater intrusion dynamics.

The findings of this research highlight that the construction of the New Lock Terneuzen will result in escalating salinity levels in the canal, necessitating the implementation of suitable measures. Among the physical measures, the saltwater trap and elevated threshold showed promising effectiveness in reducing saltwater intrusion. Continuous discharge through culverts is believed to contribute to their success. In contrast, the management measures related to upstream discharge exhibited limited potential and high uncertainty in water availability, indicating their inadequate strength in mitigating saltwater intrusion.

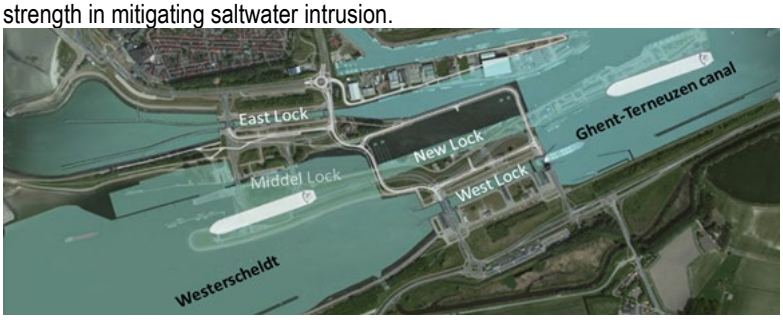

Figure 1; Overview new design (coloured part) in comparison to old design (transparent part) (iv groep, n.d.).

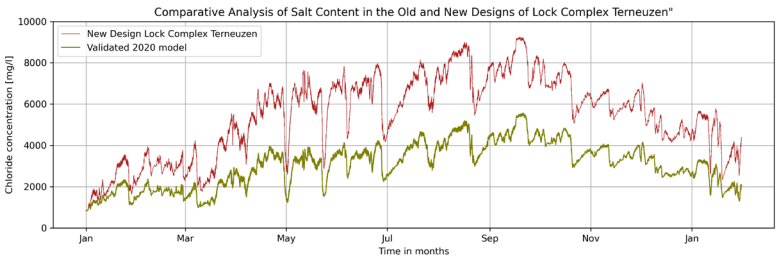

Figure 2; Comparison of New Lock Terneuzen (red) to old design (green) for expected saltwater intrusion

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