In this study, propagation dynamics of the fluid mud underflows that form as a result of pipeline dredge disposal operations in the designated areas are investigated. These areas such as wetlands, nearshore waters are typically covered with stiff, cylindrical, emergent aquatic vegetation. The main goals of this study are to propose mathematical formulations for the bottom shear force and drag force of emergent stiff aquatic vegetation acting on the gravity current, and to present novel propagation modeling approaches. To be able to predict these forces, a friction coefficient (for the bottom shear force), and a drag coefficient (for vegetation skin friction and pressure drag forces) are formulated theoretically. To verify the theoretical derivations of friction and drag coefficients, a series of constant-flux release gravity current experiments is conducted in a rectangular laboratory flume. Based on the experimental data, a relation between the Fanning friction coefficient and the gravity current Reynolds number is proposed for gravity currents propagating over smooth surfaces. Using the proposed relationship, a new viscous propagation model was developed and evaluated through comparison with experimental data for fluid mud gravity currents. Group drag coefficient for emergent cylinders is formulated in terms of the vegetation areal fraction, the flow behavior index of the fluid-mud and the Reynolds number for cylinders in arrays, which is also defined in this study, as a part of the theoretical analysis. Using the drag coefficient formulation, a closed form prediction model for propagation of gravity currents through emergent vegetation is proposed.

In addition, the data of the experiments with vegetation models are interpreted to observe the effect of emergent aquatic vegetation on the anatomy of the non-Newtonian fluid mud gravity currents. The experimental observations showed that the presence of the vegetation significantly affects the propagation dynamics, hence the anatomy, of the gravity currents. Vegetation-induced drag force dominates the resisting forces acting on the gravity current, forcing the current to transition into a drag-dominated propagation phase. During this
propagation phase the profile of the gravity current exhibits a well-defined triangular shape with an equilibrium slope angle. The equilibrium value of the slope angle was parameterized in terms of fluid mud rheological characteristics and the vegetation density.