Monitoring the heterogeneous aquatic environment such as the Stormwater Treatment Areas (STAs) located at the northeast of the Everglades is extremely important in understanding the land processes of the constructed wetland in its capacity to remove nutrient. Direct monitoring and measurements of ecosystem evolution and changing velocities at every single part of the STA are not always feasible. Integrated remote sensing, monitoring, and modeling technique can be a state-of-the-art tool to estimate the spatial and temporal distributions of flow velocity regimes and ecological functioning in such dynamic aquatic environments. In this presentation, comparison between four computational intelligence models including Extreme Learning Machine (ELM), Boltzmann Deep Learning Machine (BDLM), Genetic Programming (GP) and Artificial Neural Network (ANN) models were organized to holistically assess the flow velocity and direction as well as ecosystem states within a vegetative wetland area. First the local sensor network was established using Acoustic Doppler Velocimeter (ADV). Utilizing the local sensor data along with the help of external driving forces parameters, trained models of ELM, BDLM, GP and ANN were developed, calibrated, validated, and compared to select the best computational capacity of velocity prediction over time. Besides, seasonal images collected by French satellite Pleiades have been analyzed to address the seasonality effect of plant species evolution and biomass changes in the constructed wetland. The key finding of this research is to characterize the interactions between geophysical and geochemical processes in this wetland system based on ground-based monitoring sensors and satellite images to discover insight of hydraulic residence time, plant species variation, and water quality and improve the overall understanding of possible nutrient removal in this constructed wetland.