INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: The Limnology of Wetlands: Understanding their Dynamic Physico-Chemical and Biotic Responses to Anthropogenic Exploitations within the Aquatic Ecosystems

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SHORT ABSTRACT

This doctoral dissertation revolves around understanding the anthropogenic contamination dynamics within a wetland [Deepor Beel, Guwahati, India (a Ramsar site)], and assessing their impacts on the natural ecosystems. This incorporated four distinctive components; water column, sediment column, floral samples, and fish biota (representative of the faunal samples). Each element was assessed for its responses to the contamination levels in the event of an anthropogenic intervention. The first and foremost objective was identifying the latent pollution sources and their apportionment. For this purpose, different multivariate statistical and factorization models were employed. This followed an evaluation of the water quality employing indexing techniques, wherein novel approaches were developed and proposed to determine a water body's health status. This included developing generalized and specific (depending upon water's end-use) water quality indices (WQIs) incorporating different Chemometrics methods (i.e., multivariate statistics and Probability estimation through the water quality dataset's randomness). For the sediment column, the pollution sources were identified and apportioned through source apportionment models, which were further validated through different elemental analyses such as X-ray powder diffraction (XRD), and Scanning electron microscope - Energy Dispersive X-Ray Spectroscopy (SEM-EDS). Additionally, the sediment pollution loadings were also evaluated through various indices, such as contamination factor, pollution load index, enrichment factor, and the geo-accumulation index. Their associated potential ecological risks were also estimated, which provided the impact of one or more elements (heavy metals) on a wetland's natural ecology. Finally, chemical speciation analyses of all the heavy metals were conducted to determine their available forms in the sediment column. Furthermore, a detailed investigation was carried out on correlating the heavy metal contamination, distribution, and human health risk associated within an aquatic ecosystem. For this purpose, water, sediment, and fish samples were considered, and their heavy metal contamination and distribution were determined. The corresponding health risks were then evaluated for six different heavy metals; Cr, Cd, Fe, Mn, Cu, and Pb, upon exposure for both adults and children. The contributions to the bioaccumulation of heavy metals in the aquatic ecosystems were also assessed and compared for both water and sediment columns. Finally, the water, sediment

and floral components were integrated to develop a eutrophication-based ecological model, to understand the eutrophication levels induced by different pollution loadings and providing insights into curbing the eutrophication levels.