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**Submission contents:**

Submission to the public consultation for the Adelaide River Off-stream Water Storage (AROWS) project

Submitted by:

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I am writing this submission in regards to the Adelaide River Off-stream Water Storage (AROWS) project public consultations. I am a current PhD candidate at Charles Darwin University (CDU) who has been researching the impacts of sea level rise on freshwater coastal wetlands in the Top End floodplains for the last four years. My speciality is in aquatic ecology. After examining the Referral Report and Hydrology Impact Report I am concerned that a number of factors have not yet been considered.

My main concern is related to coastal salinisation as a result of the reduction in freshwater flow caused by the extraction of water for the AROWS project. The salinisation of coastal wetlands is known to occur through five mechanisms: 1) surface or groundwater saltwater intrusion caused by sea level rise, 2) **reductions in riverine freshwater flow**, 3) alterations of groundwater flow, 4) altered coastal geomorphology and 5) storm surges (Herbert et al. 2015). To simplify, the extent of saltwater intrusion is controlled by the balance between freshwater flows and sea levels, as well as the topography of the land.

Sea level height is increasing in the Darwin region, and the state of the climate report (CSIRO and Bureau of Meteorology 2020) approximates the rate of sea level rise is about 6 cm/decade. For reference between 1990 and 2013 there was a recorded 18.25cm increase in sea level on the north coast of Australia (Miloshis and Valentine 2013). However, it should also be noted that the rate of the increase in sea levels is also increasing (Miloshis and Valentine 2013; Herbert et al. 2015; CSIRO and Bureau of Meteorology 2020). Given the low-lying nature of floodplains and wetlands of the Northern Territory, including those of the Adelaide River floodplain, many of these freshwater areas are at risk of being inundated with salt water. The reduction of the freshwater flow in the Adelaide River has the potential to exacerbate the impacts of sea level rise on these aquatic habitats.

The current hydrologic model used in the AROWS impact assessments has not taken into account changes to the extent of tidal influence nor has there been any modelling

of the movement of salt water within the Adelaide River with or without the AROWS project. It is repeatedly stated within the Referral Report that the Adelaide River is tidal, with tidal influence upstream of the proposed extraction point (page 116, Referral Report). The argument that there will only be minor changes to river flows (page 73, Referral Report) does not consider whether or not saltwater has moved further upstream due to the reduction in freshwater flows, as while the water levels may not change due to the tidal influence it is possible that the quality (and salinity) of the water does change. It is stated in the report that the proposed point of extraction is tidally influenced and that the tidal influence is clearly “evident during periods of low flow as seawater pushes further up the river causing a brackish environment” (page 142, Referral Report).

My research has specifically examined the issue of what happens when previously freshwater habitat is inundated with saline water. When previously freshwater areas became saline or brackish it has severe repercussions on the aquatic communities (Dedman, unpublished data). It has been noted since the 1950s that saltwater intrusion is occurring in the Mary River (approximately 90km east of the Adelaide River) (Mulrennan and Woodroffe 1993; Traill et al. 2010; Miloshis and Valentine 2013). With noted impacts of saltwater intrusion within the Northern Territory including dieback of freshwater *Melaleuca* (Paperbark trees) forests and expansion of mangrove trees recorded in academic literature (Saintilan et al. 2019). My research which is currently in review for publication shows that the aquatic organisms including phytoplankton, benthic algae, zooplankton, aquatic macrophytes, macroinvertebrates and freshwater fish will also be negatively impacted, some with direct mortality as well as, reductions to the quantity and quality of the food resources available within in the ecosystem. Even species such as Barramundi (*Lates calcarifer*) which travel between freshwater and saline habitats will be impacted as many of these migratory species also rely on the high productivity and food that the freshwater habitat provides (Roberts et al. 2019).

Therefore, I would ask that the AROWS project impact assessment include modelling of sea level rise within both surface and ground water; modelling of the movement of the saltwater wedge within the river under conditions of reduced freshwater flow; modelling of the movement of saltwater within and between the river-floodplain-wetland habitats under reduced freshwater flow and increased sea level height; and consideration of the impact that this will have on the wider ecological landscape, as well as the recreational, cultural, ecological and economic values that will be impacted should the models reveal that water extraction will increase the impact of salinisation within the Adelaide River and floodplain ecosystem.

References

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