Tidal Pools Factsheet

Definition of tidal pools, impacts, ecological significance, and management by Water Sharing Plans in NSW.

What are tidal pools?

Tidal Pools are sections of coastal rivers which are affected by both tidal and catchment processes and contain a combination of saline and freshwater. Saline water is denser and sits below freshwater in the tidal zone. This is known as the saltwater wedge, and it moves up and down the river with tides and catchment inflows. Saltwater wedge estuaries are the most stratified of all estuaries, the result is a unique defined layering of salt and freshwater which migrates up and down a coastal river (Figure 1). Some coastal rivers experience higher tidal amplitude than others, and each salt wedge estuary is different, depending on a range of influencing factors. The main influences are River Flow Velocity and Water Depth. In shallower coastal rivers with significant tidal inflows combined with low catchment inflow, the saltwater wedge moves further upstream.

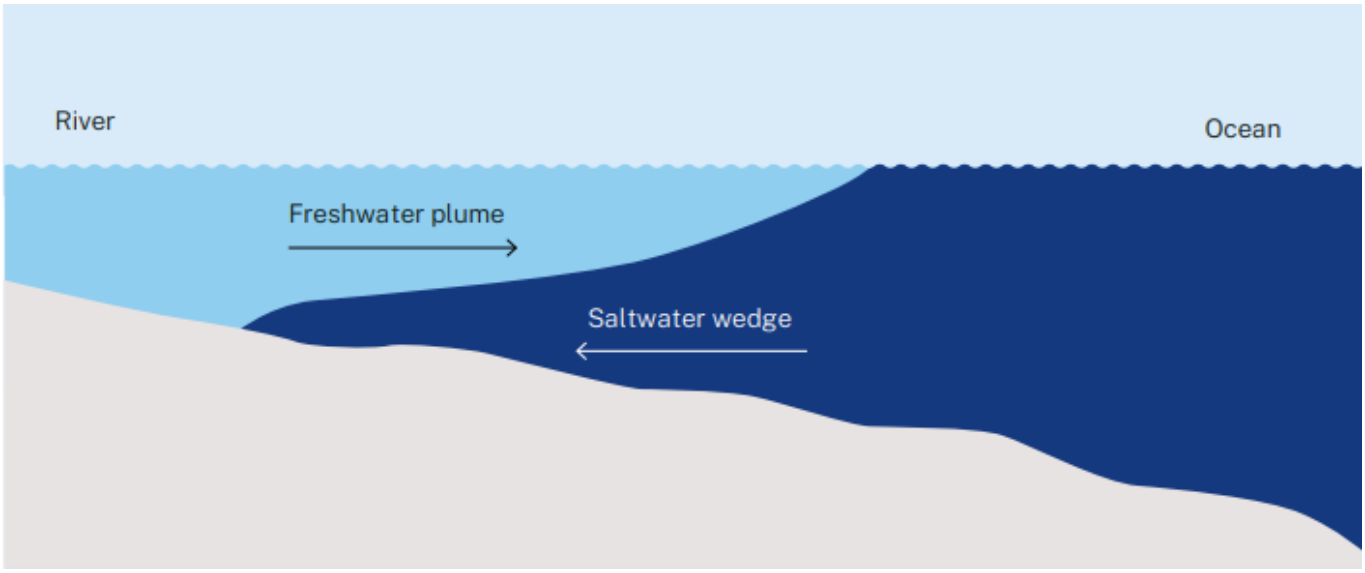

Figure 1. Concept of a tidal saltwater wedge for a permanently opened estuary[1]

In some of the larger river systems in NSW, there is a significant amount of water extracted from tidal pools. In some rivers, the tidal pool may be ephemeral (last only a short time) or may diminish significantly during periods of low flow. The movement of the salt-water wedge can have potential

[1] .Adapted from Hurdle, J. 2020, As Sea Levels Rise, Will Drinking Water Supplies Be at Risk?, Yale School of the Environment e360.yale.edu/features/as-sea-levels-rise-will-drinking-water-supplies-be-at-risk

impacts on the availability of water suitable for extraction for agricultural and industrial uses[2] and have negative impact on biota sensitive to salt levels. Several coastal water sharing plans have rules in place specifically for the equitable and sustainable management of tidal pool water resources[3].

Impacts on tidal pools

There are several aspects that affect the extent and duration of saltwater wedge movement up rivers and streams. Some of these impacts are large scale, long term climactic and others are localised due to local water variables/conditions and water usage.

Fresh water extraction from below the tidal limit currently occurs in the Hunter, Bellinger, Clarence, Hastings, and Macleay River tidal pools. Many towns also extract water from rivers and alluvial groundwater immediately upstream of the existing high tide limit, meaning that even a small increase in sea level may dramatically reduce the condition of water sources and may negatively affect:

- coastal wetlands, and freshwater and estuarine habitats such as mangroves that are critical for fauna breeding and recruitment
- town water security, domestic and stock rights and water users who currently access and rely on freshwater close to, or within, current tidal limits
- Aboriginal communities' abilities to practice culture and protect important cultural sites and assets[4].

Climate change and the build-up of greenhouse gas concentrations and associated increase in glacial and ice sheet melt is responsible for a significant change in global sea level rises[5]. The impact from these sea level changes is being felt globally. Over the past 50 years, sea levels around Australia have risen by 7cm, with the average projections for coastal NSW to be up to 58cm by the year 2070[6].

While climate science is continuously improving, current long term climate predictions suggest higher overall temperatures, changing patterns of rainfall, increased evaporation and more frequent extreme weather events[7].

[2] Glamore, W. C., D. S. Rayner, and P. F. Rahman, 2016: Estuaries and climate change. Technical Monograph prepared for the National Climate Change Adaptation Research Facility. Water Research Laboratory of the School of Civil and Environmental Engineering, UNSW.

[3] Water sharing plan status | Water (nsw.gov.au)

[4] North Coast Regional Water Strategy (nsw.gov.au)

[5] Oppenheimer et al. 2019, Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. In Pörtner et al. (Eds.), IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, Intergovernmental Panel on Climate Change.

[6] CoastAdapt 2017, Sea-level rise and future climate information for coastal councils, accessed 14 July 2020 from coastadapt.com.au/sea-level-rise-information-all-australian-coastal-councils

[7] The scenario uses the regionally downscaled factors from the NARCLiM 1.0 project to adjust the long-term past climate scenario rainfall and evapotranspiration data. Further information on NARCLiM 1.0 project is available on the NSW Government's, AdaptNSW website: www.climatechange.environment.nsw.gov.au/climate-projections-used-adaptnsw

Ecological significance

In some states, saltwater wedge estuaries have been granted legal protection due to their importance in supporting threatened ecosystems. Tidal pools where fresh, brackish and saline water mix are ecosystems of high ecological value as they contribute to high levels of productivity to coastal and nearshore marine and riverine environments. They provide unique and important refuge and breeding habitat for numerous species of invertebrates, fish and birds. The wedge acts as a barrier that prevents semi-buoyant eggs and larvae from entering the ocean. The wedge also provides a nutrient rich environment providing plentiful food for many aquatic species[8,8].

The saltwater wedge can also represent a hazard for sedentary and freshwater dominant species. In some coastal rivers where the saltwater wedge is highly stratified and there is reduced freshwater inflow, the saltwater wedge can migrate large distances. In some extreme reduced inflow events reaching much farther than normal, resulting in higher levels of mortality of sedentary bottom dwelling invertebrates[7,8].

Importance of tidal pool management

Management of water extraction from tidal pools is important as this water is used for domestic, agricultural, and industrial purposes and long-term extraction can have detrimental impacts not only to coastal river ecosystems, but also the quality and amount of water available for extraction[9]. Extraction during periods of low flow can result in the alteration of the natural flow regimes, which many aquatic species rely on for feeding and spawning cycles. Reduced flows can also cause periodic closures of estuary mouths, which limits the natural flushing of the estuaries leading to poor water quality conditions. Rules in water sharing plans are put in place to ensure the sustainable and equitable management of water within tidal pools to meet environmental, economic, social, and cultural outcomes.

Contemporary tidal pool rules

In NSW, the *Water Management Act 2000* requires Water Sharing Plans [10] to ensure equitable and sustainable sharing of water, as well as ensuring the protection of the environment, water sources and dependant ecosystems.

[8] Estuarine habitats (nsw.gov.au)

[9] Peirson, W.L., Bishop, K., Chadwick, M.J. and Nittim, R., 1999. *An investigation of the potential ecological impacts of freshwater extraction from the Richmond River tidal pool* (No. UNSW Water Research Laboratory Technical Report No. 99/51). University of New South Wales-Water Research Laboratory.

[10] Water Management Act 2000 No 92 - NSW Legislation

While flow and water quality conditions in tidal pools can be highly variable depending on location, the following rules are commonly applied in NSW to help meet and maintain Water Sharing Plan objectives:

- Cease to pump (CTPs) rules imposed during periods of low flow or poor water quality (examples in Table 1).
- Conditions imposed on trade of water in, out and between water sources.

Table 1. Tidal Pool CTP examples*

Water Sharing Plan	CTP trigger	Reference gauge	Number of CTP days 01/06/2019 – 01/12/2023 (1645 days)
Richmond River Area 2023	Average electrical conductivity at 25°C for the previous day was more than or equal to 4000 µS/cm	Richmond River at Coraki gauge (203403)	38 (2.3 %)
Tweed River Area 2023	Flow of 2ML/day or less	Rous River at Boatharbour No. 3 gauge (201005)	91 (5.5 %)
Bellinger River Area 2020	Flow of less than or equal to 56 ML/day	Bellinger River at Fosters gauge (205016)	119 (7.2 %)
Clarence River 2016	Flow of less than or equal to 86 ML/ day	Clarence River at Lilydale (Newbold crossing) gauge (204007)	62 (3.7 %)
Hastings 2019	Flow of less than or equal to 29 ML/day	Hastings River at Ellenborough gauge (207004)	144 (8.8 %)

Data taken from: https://realtimedata.waternsw.com.au/

More information

The draft water sharing plan and other fact sheets are available on the department's Water website.