

To flush or not to flush?: Can an artificial channel help save the Tuggerah Lakes?

In 2017, with elections for the newly amalgamated Central Coast Council looming, the Save Tuggerah Lakes political party (STL) entered the race.¹ Immediately, the title of the party begs questions; save the Tuggerah Lakes from *what?* or, perhaps more accurately, save the Tuggerah Lakes from *who?* Thus begins the saga of the environmental history of the Tuggerah Lakes. Public desire to save the Tuggerah Lakes emerged in the latter part of the twentieth century, when noticeable changes indicated their ecological health was in decline, and, as the STL's very inception attests, continues to be so today. Over the years, many have proposed that the solution lies in the construction of a permanent, deeper, wider, artificial mouth of the southern channel at The Entrance, designed to flush the Tuggerah Lakes of their detritus.² Today, the STL takes a similar stance.³ The purpose of this paper then—from an environmental history standpoint—is to ascertain whether an artificial channel is the answer to saving the Tuggerah Lakes, by addressing the flipside of the above questions—*for whom* are we saving the Tuggerah Lakes? To determine this, the first step is to unravel the events and processes that led to the decline. Initially, this requires an awareness of the twin concepts—the geological formation of the Tuggerah Lakes and the anthropocentric customs of British colonisation—that together forged the cultural landscape of the twenty-first century Tuggerah Lakes. From this foundation, an appreciation can be gained of the major human actions—comprising two distinct eras, agriculture and urbanization—and what can be conceived of as the Tuggerah Lakes corresponding reactions that resulted in the decline. Thus, cognizant of what has transpired to date, it becomes possible to view the proposed solution as an extension of the anthropocentric customs that have been steadily imprinted on the Tuggerah Lakes cultural landscape for the past two

¹ Clare Graham, "Save Tuggerah Lakes Party puts up candidates to contest all five wards in September's council election," *Central Coast Gosford Express Advocate*, April 14, 2017, <http://www.dailytelegraph.com.au/newslocal/central-coast/save-tuggerah-lakes-party-puts-up-candidates-to-contest-all-five-wards-in-septembers-council-election/news-story/7282328c4f31637868954d40e4d1e851>

² "Opening The Entrance," *The Lakes Advocate*, May 21, 1986, quoted in Joanne Allison and Anthony Scott, *The Ecological History of Tuggerah Lakes. What the Newspapers Said...* (Sydney: Sainty & Associates and CSIRO Land & Water, 1998), 44; Alistair Gilmour, Greg Walkerden and James Scandol, "Adaptive Management of the Water Cycle on the Urban Fringe: Three Australian Case Studies," *Ecology and Society* 3, 1 (1999): 6.

³ Save Tuggerah Lakes, "Our Beliefs," accessed November 1, 2017, <http://savethelakes.com.au/our-beliefs/>

centuries; and, in considering who we are saving them for, allows for a discussion on whether or not it is from this anthropocentric platform that future efforts to 'Save Tuggerah Lakes' should be implemented.

Almost two centuries ago, geology offered up the Tuggerah Lakes canvas to British colonizers, although, comprising Lake Munmorah, Budgewoi Lake and Tuggerah Lake, the Tuggerah Lakes, despite their name, are not actually lakes; geologically, they are coastal lagoons. Characterized as such, by their broad basin, shallow depth, traditionally nutrient-poor state, low-energy environment, barrier sand bars and narrow entrance channel, which historically was often closed to the ocean for extended periods, unless, as is recent practice, a dredged channel is maintained.⁴ The Tuggerah Lakes formed at the end of the last ice age, when an indentation in the coastline filled with sea-water and eventually, through the action of wind and water, formed the two barrier sand bars, one to the north (stretching from Wybung Head to Noraville) the other to the south (stretching from Norah Head to The Entrance) that would effectively isolate the three lagoons from the ocean. Additionally, it is absolutely critical to recognize that the Tuggerah Lakes does not merely comprise the three lagoons themselves but also the 670km² of surrounding land that forms its catchment.⁵ The lagoons effectively form a sink and drain the catchment's four main waterways (Wyong River, Ourimbah Creek, Tumbi Umbi Creek and Wallarah Creek) and their associated tributaries. This means all fresh water, suspended sediments, dissolved/suspended organic matter and nutrients from the catchment, are transported by these waterways to the lagoons, inevitably impacting upon them.⁶ Therefore, any discussion of saving the Tuggerah Lakes, must account not only for the lagoons themselves but also for all actions and transformations that have taken place in the catchment over the past two centuries.

⁴ Arthur McComb, "Introduction," in *Eutrophic Shallow Estuaries and Lagoons*, ed. Arthur McComb (London: CRC Press, 1995), 2.

⁵ Allan Strom, "*a guide to a study of the environment of the upper tuggerah lakes*," (Sydney: NSW National Parks and Wildlife Service, 2000), 3.

⁶ McComb, "Introduction," 1.

Whilst geology may have offered up the canvas, which, it must be recognized after countless millennia of occupation by local Aboriginal groups, was by no means blank, it was the vastly divergent principles and practices of the British colonisers that would determine how they and their descendants would take their turn in fashioning that canvas. Today, these principles and practices have come to be recognized as anthropocentric in nature. Emerging in the Age of Enlightenment, anthropocentrism can be seen as a world view in which certain cultures, predominantly those Western in orientation, have come to see themselves as both separate from nature and superior to it.⁷ Essentially, and largely subconsciously, the people of these cultures tend to view themselves as the pivotal element of their environment, with plants, animals, inanimate objects, air and water, simply available to satisfy their needs and wants. In this sense, nature is no longer valued intrinsically, that is purely because it exists, but rather instrumentally, as an economic resource to be consumed and managed, valued only insofar as it satisfies the desires of current generations. Deeply embedded in these cultures to the point that until recent times it has rarely been recognized or challenged, anthropocentrism is best demonstrated through the use of example.⁸

In relation to the Tuggerah Lakes, the primary source literature provides ample evidence of anthropocentric principle and practice. In 1909, the NSW Government Tourist Bureau released the *Tourist Handbook of the Hawkesbury River and North Coast Lake District*, seemingly as a means to encourage tourists to take advantage of the Northern Railway Line, to experience the natural wonders of the destinations along its corridor. However, whilst the handbook does promote tourist venues such as the Wyong Caves and the boarding houses of The Entrance, it places considerably greater emphasis on the possibilities for the development of the district, through the utilization of its natural resources. Quotes, such as "provides employment for numbers of timber-getters," "an extensive tract of swamp...[where the] soil is capable of growing almost any of the products of the

⁷ David Keller, "What is Anthropocentrism?: Introduction," in *Environmental Ethics: the big questions*, ed. David Keller (West Sussex: Wiley-Blackwell, 2010), 59.

⁸ Keller, *Environmental Ethics*, 59.

sub-tropical zone," "perch are plentiful. Gill-birds and pigeons afford the best shooting" and "extensive improvements...of the Wyong River...enabling launches to run direct from the entrance to meet the trains at Wyong," allude to the anthropocentric nature of the activities referenced within. Human aspirations are clearly prioritized, with nature perceived purely as either a resource to be exploited, enhanced or a hindrance to be dealt with.⁹ However, in 1909, these philosophies and practices, endorsed by the government through publications such as this, would have been culturally consistent, in a land deemed to possess limitless resources, in a fledgling nation striving to prove itself, with people firm in the belief that human industry was the key to improving upon the canvas nature had provided for them.¹⁰

Just as in 1979, when the final *Tuggerah Lakes Study Report* was released by the Inter-departmental Committee, despite the known deteriorating ecological health of the Tuggerah Lakes, urban development, which in fuelling economic growth was viewed as critical for the region's progress, remained the culturally consistent brush stroke of this era's decision makers. The report, which itself quotes being commissioned because "The Government of New South Wales is anxious to preserve the lakes system as a natural asset for the enjoyment both of residents of the Wyong area and visitors to the region.," reveals that this was the case only insofar as it fostered urban development in the region.¹¹ The quote, "The Inter Departmental Committee decided in 1976 to examine the importance of the Tuggerah Lakes and associated areas as breeding grounds for bird life. Another reason for the study was because of their aesthetic appeal. People enjoy seeing birds.," clearly demonstrates that interest in saving the habitat of the birds was not simply for their intrinsic value, but also for their instrumental value, in attracting people, they subsequently benefited the region.¹²

Whilst the quote "It has been proposed that large scale dredging and reclamation be carried out to

⁹ NSW Government Tourist Bureau, *Tourists' Handbook of the Hawkesbury River and North Coast Lake District*, (Sydney: William Applegate Gullick, Government Printer, 1909), 40, 41, 43 & 45.

¹⁰ Rodney Grainger, "In the Steps of the Illawarra Cedar-Getters" *Forest History Newsletter* 16, 1 (1972): 18.

¹¹ NSW Department of Public Works, *Tuggerah Lakes Study Report*, (Sydney: NSW Department of Public Works, 1979), Foreword.

¹² NSW Public Works, *Study Report*, 37.

create more pleasant conditions for swimmers and for boating. It is not considered that benefits from this work would compensate for the ecological disturbance to the natural lake bed," firmly relegates nature to second place, behind fostering urban development through the provision of recreational amenity.¹³ Although in 1979 an environmental consciousness had emerged, it remained anthropocentric in nature; that is to say, interest in protecting the Tuggerah Lakes extended only insofar as it either benefited or hindered humans.

Perhaps for the twenty-first century reader then, quotes that spark incongruity in a tourist brochure from 1909 and those that seem controversial in a government planning document from 1979, might be conceived of a little differently, if considered from the angle of that which is culturally consistent today. Today, because these things offer convenience to those with busy schedules, what thought is given to consuming water from a disposable, plastic bottle? Or having a car for every member of the family with a drivers licence? Or just how these equally anthropocentric customs will impact upon the ecological health of the Tuggerah Lakes now and in the future? Or that they will undoubtedly be looked upon disparagingly by those living in the region a century from now, just as today's reader may be tempted to disparage those from 1909 and 1979. Environmental history, however, is not about casting aspersions on the actions of the past, it is about illuminating them, to facilitate alternate choices for the future.¹⁴ So, when the discussion that follows is perceived mindful of this, it serves simply to illuminate the circumstances that allowed geology and anthropocentrism to coalesce in the Eutrophication of the Tuggerah Lakes, in the closing decades of the twentieth century.

When the decline in the ecological health of the Tuggerah Lakes reached its pinnacle in the late 1980's, early 1990's, the Tuggerah Lakes were deemed Eutrophic, indicating that rather than being

¹³ NSW Public Works, *Study Report*, 10.

¹⁴ Stephen Dovers, "Australian environmental history: introduction, reviews and principles," in *Australian Environmental History: Essays and Cases*, ed. Stephen Dovers (Melbourne: Oxford University Press, 1994), 15.

their customary state of nutrient-poor, they were overloaded with nutrient enrichment.¹⁵ On the surface, particularly along the shorelines, this resulted in the excessive growth of macroalgae (seaweed) and microalgae (phytoplankton) blooms, whilst beneath the surface, it resulted in the decimation of large areas of seagrass beds. From a human standpoint, as these algae plagues enveloped the Tuggerah Lakes, they hindered fishermen by inhibiting the momentum of boats through the water and, as algae decomposed in piles (wrack) along the shorelines, turning them to sludge, greatly reduced the amenity of the lakes for recreational users.¹⁶ From the standpoint of the more-than-human biota who inhabit the Tuggerah Lakes, the loss of seagrass beds was devastating, as not only do they assist in maintaining sediment stability and water quality, they also provide food, shelter and a nursery for many species of these biota, such as fish, prawns and benthic flora and fauna.¹⁷

Essentially, at the time, the Eutrophication of the Tuggerah Lakes left many convinced that the only solution to restoring their ecological health, lay in the construction of either a second channel to the ocean at Budgewoi Lake or a significant and permanent upgrade of the current channel at The Entrance, designed to permit the Tuggerah Lakes to rid themselves of excess nutrients through enhanced interaction with the ocean; essentially, to flush them.¹⁸ Today, despite improvements in the ecological health of the Tuggerah Lakes, meaning they are no longer deemed Eutrophic, a walk along the shoreline reveals these problems endure.¹⁹ If the sulphurous odour of decomposing wrack does not deter one, the squelch of sludge between one's toes as one attempts to enter the water

¹⁵ Danny Roberts and Kevin Butler, *Tuggerah Lakes Estuary Process Study: Summary Report* (Wyang: Wyong Shire Council, 2001), 7.

¹⁶ Anthony Scott, *Tuggerah Lakes: way back when...* (Sydney: Sainty & Associates, 2002), 44-61.

¹⁷ A.K. Smith, J.E. Holliday and D.A. Pollard, "Management of Seagrass Habitats in NSW Estuaries," *Wetlands Australia* 16, 2 (1997): 48.

¹⁸ Gilmour, Walkerden and Scandol, "Adaptive Management," 6 & 9. "Opening The Entrance," *Lakes Advocate*, 1986.

¹⁹ Wayne Erskine, "Flood-tidal and fluvial deltas of Tuggerah Lakes, Australia: Human impacts on geomorphology, sedimentology, hydrodynamics and seagrasses, in *Deltas: Landforms, Ecosystems and Human Activities*, ed by G. Young and G. Perillo (London: International Association of Hydrological Sciences, 2014), 163.

surely does.²⁰ So, it seems only logical then that the push for an enhanced channel persists. However, for the majority of their six-thousand plus year existence, the Tuggerah Lakes did function on a single channel, often closed for extended periods of time; suggesting it would be remiss not to address the question, how did the Tuggerah Lakes come to require more flushing than the existing channel naturally provides? It is a question, whose complicated answer is situated in the intergenerational activities of the colonisers of the Tuggerah Lakes over a period of almost two centuries.

From the late 1820's onwards settlers began moving to the Brisbane Water district (encompassing the Tuggerah Lakes at that time) and from the early 1830's, the heavily timbered catchment would prove a bonanza for timber cutters, commonly known as cedar-getters.²¹ As early as 1832 it was recognized that the cedar-getters left in their wake a trail of destruction and in 1835 the government introduced licensing restrictions to regulate the practice in the region. To no avail, however, with authorities again expressing concern in the 1840's at the sheer volume of timber being removed from the district.²² Although, it must be stated, these examples are supplied simply to highlight the immense quantity of timber being felled, because at the time the government's motivation was not the destruction of habitat but rather the accumulation of taxes.²³ Unabated, spreading ever outwards from its origins in Blue Gum Flat (Ourimbah), and spurred by the opening of the railway in 1889, the industry at its peak produced in excess of twenty-thousand feet of timber per week, continuing this way until well into the twentieth century.²⁴

Filling the void left by the felled trees, agriculture was hot on the heels of logging, advancing in leaps and bounds in the Tuggerah Lakes catchment from the late 1800's. By 1885, Anderson had cleared

²⁰ Author's personal observations on multiple occasions between July-Oct 2017, whilst researching this paper.

²¹ Charles Swancott, *Blue Gum Flat To Budgewoi: The story of Wyong Shire's Wonderful Valleys, Lakes and Beaches*, (Gosford: Berkelouw Bookdealers, 1963), 2.

²² Wendy Thorp, *Thematic History: Wyong Shire Heritage Study*, (Wyong: Wyong Shire Council, 1994), H28.

²³ Grainger, "In the Steps," 18.

²⁴ Swancott, *Blue Gum Flat To Budgewoi*, 18.

600 acres on his Ourimbah farm and planted 700 varieties of fruit tree, whilst in the Wyong and Yarramalong valleys, early farmers were successful with wheat and maize.²⁵ Agriculture, however, like logging, would truly take hold when the railway came through in 1889 and provided easy access to the Sydney markets. The region eventually became one of the top four citrus producers in the state, as well as home to over 160 dairy farms. In 1906, three truckloads of fruit were leaving the region by train each day. By 1932, one and a half million gallons of milk were produced annually. In 1936, 63,000 acres of Peats Ridge, Kulnura and Mangrove Mountain were under citrus orchard, and by the 1950's, the region produced between 75,000 and 125,000 bushel cases of citrus annually. When the dairy industry, which had been situated in the lower lying valleys, declined from the 1950's, many of these farms converted to turf, the main agricultural industry that persists in these valleys today.²⁶ Combined, these statistics reveal that logging and agriculture represented a mammoth human undertaking in the early colonial to mid twentieth century era of the Tuggerah Lakes environmental history.

The problem with logging and agriculture, however, beyond the immediate devastation of habitat and the fact that cedar as a species is now virtually extinct in Australia, is that when a catchment is cleared in such a totalizing manner, it renders it susceptible to erosion.²⁷ In 1979, studies revealed that 19% of the Tuggerah Lakes catchment was affected by sheet erosion, with one third of this occurring on lands previously logged and the other two thirds occurring on lands either engaged in or previously engaged in agricultural pursuits.²⁸ Inevitably, even the soil eroded from the upper reaches of a catchment will filter its way as sediment into the waterway; a process that can take decades or even centuries.²⁹ Although it will be demonstrated later that logging and agriculture are

²⁵ Swancott, *Blue Gum Flat to Budgewoi*, 34.

²⁶ Swancott, *Blue Gum Flat to Budgewoi*, 85 & 245.

²⁷ Grainger, "In the Steps," 17.

²⁸ NSW Public Works, *Study Report*, 16.

²⁹ Robert Wasson and Aleksey Sidorchuk, "History for soil conservation and catchment management," in *Environmental History and Policy: Still Settling Australia*, ed. Stephen Dovers (South Melbourne: Oxford University Press, 2000), 97.

not the sole culprits of anthropocentric induced sedimentation in the Tuggerah Lakes, nevertheless, long term estimates reveal that the rate of sedimentation for the Tuggerah Lakes prior to the 1950's averaged 1.4mm per annum, whereas in the latter decades of the twentieth century, this had increased to an average of 11mm for Lake Munmorah, 10mm for Budgewoi Lake and 4mm for Tuggerah Lake per annum.³⁰ Sedimentation, through human actions on catchment lands, had become a considerable burden for the Tuggerah Lakes.

Basically, as they fill with sediment, the Tuggerah Lakes are getting shallower and this has significant consequences. Firstly, the shallower they become, the more of the lagoon bed that sits in the photic zone; the zone capable of engaging in photosynthesis and promoting the growth, or in this case, the excess growth of macroalgae, microalgae and seagrass beds in shoreline areas. Secondly, as water in the Tuggerah Lakes is mixed primarily by wind action, it becomes more turbid as the wind churns the water and stirs the sediment through the water column.³¹ Ironically, studies have shown that turbidity has the exact opposite effect, because it interferes with light penetration in deeper waters and reduces the photic zone, thereby resulting in the loss of the vital seagrass communities that inhabit these deeper areas. This is consistent with findings for the Tuggerah Lakes, which recorded a significant drop in seagrass coverage from between 28.2-41.9% coverage in the 1960's, to between 17-25% coverage in the 1980's.³² Fundamentally, in addition to promoting the growth of harmful macro and micro algal blooms in shoreline areas, sedimentation has effectively reversed the orientation of seagrass communities, with increased sedimentation promoting their growth in shoreline areas, whilst simultaneously decimating those that customarily grew in the deeper parts of the Tuggerah Lakes.³³

³⁰ Robert King and Bruce Hodgson, "The Tuggerah Lakes System, New South Wales, Australia," in *Eutrophic Shallow Estuaries and Lagoons*, ed. Arthur McComb (London: CRC Press, 1995), 26.

³¹ McComb, *Eutrophic Shallow Estuaries and Lagoons*, 2.

³² King and Hodgson, "The Tuggerah Lakes System," 27.

³³ Peter Macreadie, Timothy Rolph, Claudia Schroder-Adams, Ron Boyd and Charles Skilbeck, "Holocene Record of Tuggerah Lake Estuary Development on the Australian East Coast: Sedimentary Responses to Sea-Level Fluctuations and Climate Variability," *GeoResJ* 5 (2015): 58.

Furthermore, compounding the effects of sedimentation, erosion caused by agriculture, particularly twentieth-century intensive agriculture, brings not just sediments but sediments laden with massive injections of the nutrients found in many commercial fertilizers.³⁴ This is problematic because prior to the British colonisation of Australia, with feeder streams and surrounding wetlands trapping and recycling the majority of nutrients for their own use, the biota of the Tuggerah Lakes had adapted to being nutrient-poor.³⁵ Moreover, due to the seasonal and episodic nature of the catchment's annual rainfall, these nutrients now tend to make their way in irregular but concentrated bursts downstream and into the Tuggerah Lakes. Unfortunately, thanks to minimal tidal interchange with the ocean, the majority of them will be retained by the Tuggerah Lakes.³⁶ Once there, they complicate the equation, in that they now provide an alternate and substantial food source for the macroalgae, microalgae and seagrass beds, already favoured by the shallower waters.

Sidelining the augmented quantity of nutrients then, the issue for the Tuggerah Lakes becomes the inability of feeder streams and wetlands to trap and recycle the sediments and nutrients in the manner they traditionally had. In short, after almost two centuries, there are very few areas of undisturbed natural vegetation remaining in the Tuggerah Lakes catchment, with none more so destroyed or degraded than the salt marshes and wetlands that traditionally inhabited the low lying shorelines of the Tuggerah Lakes. Approximately 85% of the catchment's wetlands and salt marshes have been filled to create land suitable for development.³⁷ The downside of this, is that salt marshes and wetlands, like seagrass beds, play a critical role in maintaining the health of coastal lagoon systems. Not only do they provide habitat for a number of fish and bird species, many now

³⁴ Smith, Holliday and Pollard "Management of Seagrass," 49.

³⁵ McComb, *Eutrophic Shallow Estuaries and Lagoons*, 2.

³⁶ L.C. Collett, A.J. Collins, P.J Gibbs and R.J West, "Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: a Case Study in Tuggerah Lakes, New South Wales," *Australian Journal of Marine and Freshwater Research* 32 (1981): 564.

³⁷ Wyong Shire Council, *Snapshot of the Tuggerah Lakes Estuary Management Study*, (Wyong: Wyong Shire Council, 2005), 11.

threatened or rare because these wetlands are their only home, they also assist with the breakdown of macroalgae wrack and, most importantly, they assist the feeder streams with collecting and filtering sediments and nutrients, to prevent them entering the actual lagoons.³⁸ Therefore, with the feeder streams themselves compromised by erosion—such as that caused by the clearing of snags in the Wyong River to facilitate the passage of launches—and effective salt marshes and wetlands now almost all developed, the result is the Tuggerah Lakes inability to process the increased nutrient enrichment foisted upon them.

The development of the Tuggerah Lakes catchment, particularly the urban development that would result in the decimation of not only the salt marshes and wetlands but also many other areas, was a gradual evolutionary process. At first, the district was inhabited mainly by those engaged in the logging and agricultural industries, however, just as the train line increased their capacity for output from the district, so too the train line increased the migration of settlers into the district. In the early twentieth century, when Albert Warner had the forethought to subdivide his twelve-thousand acre property, the Warner Estate, he quite possibly never imagined the sheer number of people who would call the area home by the end of the twentieth century.³⁹ Initially, tourists were drawn by the sheltered waters of the lagoons, perfect for camping, swimming, fishing, prawning, boating and hiking. Eventually, many of these tourists would come to view the Tuggerah Lakes as their ideal retirement location.⁴⁰ In 1954, the Wyong Shire had a permanent population of just over 13,000. Camping, was giving way to caravanning and permanent residency, with the 360 buildings approved for construction in 1947, jumping to just over 1000 in 1960. When the F3 Freeway reduced travel time between Sydney and the Tuggerah Lakes to a manageable drive, the region became the fastest growing in south-eastern Australia in the 1970's. By 1990, 102,000 people would call the region

³⁸ Tuggerah Biodiversity Committee, *Wetlands of the Tuggerah Lakes Catchment: A report by members of the Tuggerah Biodiversity Committee in the Tuggerah Lakes Catchment*, (Tuggerah: Tuggerah Biodiversity Committee, 1997), 9.

³⁹ Swancott, *Blue Gum Flat to Budgewoi*, 126.

⁴⁰ Thorp, *Thematic History*, H21.

home.⁴¹ Apart from the destruction of wetlands, this staggering increase in population from the mid to late twentieth century, represents the second significant era in the environmental history of the Tuggerah Lakes and would place an immense burden on them, particularly via way of sewage and stormwater run-off.

Although mitigation works, the reticulated sewage scheme completed in the late 1990's, would eventually reverse the Tuggerah Lakes' classification as Eutrophic, the effects of stormwater run-off, continue to wreak havoc in a similar manner today.⁴² Entering at various points, stormwater run-off, just as sewage did previously, now overwhelmingly provides the principal source of sediments and nutrient enrichment entering the Tuggerah Lakes and has its greatest impact on the nearshore zone, the first one-hundred metres from the shoreline. In this zone, the shallow seagrass beds that are the legacy of Eutrophication, act to trap the sediments and nutrients entering with the run-off and perpetuate the cycle of macro and micro algal blooms. As these blooms decay, they are responsible for turning the once sandy shorelines to the organic ooze, whose rotten-egg smell permeates the immediate environment.⁴³ Toxic to plant and animal life, the ooze also effectively denudes an area of all marine biota.⁴⁴ Despite further mitigation efforts, which saw the placement of gross pollutant traps on major sediment drains—eyesores in and of themselves along lagoon foreshores—and sediment traps on urban drains, stormwater run-off today sees the Tuggerah Lakes hovering again on the verge of Eutrophying.⁴⁵

20,000 feet of timber per week in 1889, 63,000 acres of orchard in 1936, 102,000 people in 1990 and 85 per cent of wetlands gone today; staggering statistics that encapsulate the anthropocentric

⁴¹ Thorp, *Thematic History*, H21.

⁴² Gilmour, Walkerden and Scandol, "Adaptive Management," 6; King and Hodgson, "The Tuggerah Lakes System," 24.

⁴³ Rebecca Swanson, Angus Ferguson and Peter Scanes, *Recommendations for Management of Ooze in Tuggerah Lakes*, (Sydney: Office of Environment & Heritage, 2013), 3.

⁴⁴ Swanson, Ferguson and Scanes, *Recommendations*, 5.

⁴⁵ King and Hodgson, "The Tuggerah Lakes System," 27.

colonization of the Tuggerah Lakes and demonstrate how a series of seemingly unrelated human activities on catchment lands, have in fact converged to detrimentally impact on the ecological health of the Tuggerah Lakes and their more-than-human occupants. Therefore, now acutely aware of that interconnectivity and of the anthropocentric mindset that has largely guided actions to this point, we need to determine if it is from this same standpoint that we wish to move forward. Are we interested only in saving the Tuggerah Lakes for their instrumental value to humankind? Or can we adopt a more ecocentric mindset?⁴⁶ One that encourages saving the Tuggerah Lakes for the intrinsic value of all more-than-human life; the benthic flora and fauna that perish as a result of organic ooze, the species of bird life, endangered due to the filling of wetlands, the seagrass communities that traditionally inhabit the deeper lagoon beds and the marine biota who depend on them for their survival. If the decision is to strive for an ecocentric balance, then we must carefully scrutinize all potential solutions for their ability to help reach this goal.

On the surface then, the premise of a permanent channel that would increase the tidal flow between the Tuggerah Lakes and the ocean, thereby assisting them to flush the influx of sediments and nutrients they receive from the catchment, does not seem to be an unreasonable idea. Until scratching below the surface, reveals several reasons for more-than-humans, why this is not the case. At present, the tides have a very minimal impact on the Tuggerah Lakes, with less than 1 per cent of their volume flowing in and out on each tide.⁴⁷ Essentially, this means the water in the Tuggerah Lakes enters through catchment rainfall. As this volume of water is generally greater than that flowing out on the tide, except for in times of drought, the water level in the Tuggerah Lakes sits on average around ten centimetres above sea level.⁴⁸ If a permanent channel were constructed and more water was enabled to flow out, this would reduce the level of the lagoons by roughly the same ten centimetres. Whilst this volume may seem insignificant—in lagoons that are already stressed—

⁴⁶ Keller, *Environmental Ethics*, 59.

⁴⁷ King and Hodgson, "The Tuggerah Lakes System," 20.

⁴⁸ NSW Public Works, *Study Report*, 8.

ten centimetres would expose further areas to the photic zone and additionally expose considerable areas of mud-flats presently underwater, worsening current conditions.⁴⁹ Additionally, the existing dredging regime of the channel has already altered the salinity levels of the Tuggerah Lakes, which history shows can fluctuate anywhere from 5 per cent in times of flood to 49 per cent in times of drought. In making them more constantly saline, the biodiversity of the more-than-human species that can survive in the Tuggerah Lakes has been affected, favouring those who prefer higher salinity at the expense of those who prefer brackish conditions.⁵⁰ Finally, modelling undertaken has demonstrated that increased tidal flow from a permanent channel would not extend beyond Pelican Island and the northern half of Tuggerah Lake, meaning the significant flushing required would not actually occur.⁵¹ Based on these findings then, a permanent channel does not seem a viable solution for assisting the more-than-humans of the Tuggerah Lakes to cope with the effects of erosion, sedimentation and nutrient enrichment, and perhaps suggests an alternate rationale to campaign for this solution.

That rationale is to alleviate the affects of flooding. The level ground that initially spurred development in and around the shores of the Tuggerah Lakes, would prove a downfall in times of flooding. In the twentieth century alone, significant floods were recorded in 1927, 1946, 1949, 1964 and 1990.⁵² With the debate calling for a permanent channel at The Entrance, raging since at least the 1930's.⁵³ Ironically though, from the more-than-human standpoint, the flooding caused by the build up of water behind the barrier sand bars of Karagi Point at The Entrance, is actually beneficial. Flooding assists with the inundation of the surrounding low-lying wetlands, it scours The Entrance

⁴⁹ Wyong Shire Council, *Snapshot*, 34.

⁵⁰ Scott, *Tuggerah Lakes: way back when*, 151; King and Hodgson, "The Tuggerah Lakes System," 23.

⁵¹ NSW Public Works, *Study Report*, 8.

⁵² Scott, *Tuggerah Lakes; way back when*, 161.

⁵³ Entrance Guardian, The, "Permanent entrance channel - letter to the editor," June 1, 1939, quoted in Joanne Allison and Anthony Scott, *The Ecological History of Tuggerah Lakes. What the Newspapers Said...* (Sydney: Sainty & Associates and CSIRO Land & Water, 1998), 41; Wyong and Lakes District Advocate, "Volume of Water In Tuggerah Lakes Becoming a Hazard," July 16, 1958, quoted in Joanne Allison and Anthony Scott, *The Ecological History of Tuggerah Lakes. What the Newspapers Said...* (Sydney: Sainty & Associates and CSIRO Land & Water, 1998), 43.

channel wide and deep in a manner that dredging inhibits and it facilitates the entry and exit of the variety of fish and prawns who need this wide, deep channel to pass through, to breed in the ocean, before returning to the Tuggerah Lakes.⁵⁴ Unfortunately, however, the majority of those who debate the impacts of flooding in the Tuggerah Lakes, do not recognize these benefits, because they campaign from an anthropocentric standpoint, for a solution that benefits humans alone. In fact—although most likely unwittingly, because our practice of putting our human needs first is so deeply ingrained—they campaign for a solution that evidence suggests will actually prove even more detrimental to those more-than-humans who already bear the brunt of two centuries of anthropocentric principle and practice.

It seems then that the concept of saving the Tuggerah Lakes by constructing a permanent channel clouds the real issue, because this solution fails to address the root cause of the decline—human actions on catchment lands. Perhaps it might be best described as a solution that simply allows for business as usual in the catchment, rather than one that forces us to consider altering those behaviours that result in erosion, sedimentation and nutrient overload. However, what an environmental history perspective can also help us recognize, is that just as our predecessors could never have predicted the Pandora's Box their actions would unleash, so too, we cannot accurately predict the repercussions of ours, should we choose to irrevocably alter a fundamental system of the Tuggerah Lakes. Perhaps we need to imagine ourselves in the place of someone conducting an environmental history a century from now; do we want to be known for culturally consistent anthropocentric customs that followed in the footsteps of our predecessors? or for customs that stood out and saw us band together to truly 'Save Tuggerah Lakes'.

To borrow a twenty-first century catchcry, '*what happens in the Tuggerah Lakes catchment, stays in the...*' No! Actually it does not. What happens in the Tuggerah Lakes catchment inexorably ends up in

⁵⁴ Scott, *Tuggerah Lakes: way back when*, 151.

the Tuggerah Lakes coastal lagoons. At the moment, this means the Tuggerah Lakes coastal lagoons are burdened by almost two centuries of anthropogenic sediments and nutrients, in a swirling mass of organic ooze; and it is up to us whether or not they remain this way. Therefore, it is the considered opinion of this paper, in addressing the question, to flush or not to flush? the answer is no, an artificial channel cannot help save the Tuggerah Lakes; especially if that means saving them for more-than humans and humans alike.

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