Chapter 5

Digging deeper: ground tanks and the elusive Indian Archipelago

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THE INLAND RIVERINE PLAINS of western NSW and Queensland, which form important elements of what John McCarty described in the 1970s as the 'Inland Corridor', used to be depicted as the stable and productive grain bowl of the national economy. It was certainly the locus of some of the nation's most powerful settler myths, including the iconic legend of the mateship of the itinerant bush workforce. From the earliest colonial governors, the goal of the settler state had been to bring order to the colony by defining and allocating its land. Survey lines, later materialised as fences, have symbolised this focus on land as a basic structure of the economic, political and social order of the nation, as they marked out the freehold, the leasehold and the reservations, giving boundaries to the names traced onto the parish maps which testified to the consolidation of this symbolic as much as material order. The ethos of the itinerant workers might seem to have contradicted this stable order of settled residents, yet for all the camaraderie of the track, bush workers despised, but also longed for, the cocky's block.

McCarty's work attempted to open up this sense of stability, suggesting the region had the qualities of a passageway, yet the sustained desire for a secure and productive rural agriculture proved hard to shift. The focus on land and fence lines has continued, even as the commercial viability of the region has been fragmented by drought and changing markets. The goal of this book is to open our eyes to a new vision of the Inland Corridor, destabilising assumptions about its immobility and building instead upon McCarty's idea of the movement which could be expected in a corridor. I have found water to be a valuable metaphor for the flow of people, ideas and technology which have washed up and down this corridor.

Flow is particularly helpful as a metaphor for the upper Darling

flood plain, the centre of my work, where the run of the land, the soils and their qualities have all been crafted by the very real flow of water as well as its symbolic dimensions. Along the centre of this section of the Inland Corridor runs the Darling River, fed across its northern expanse by the many-stranded tributaries which run from the south-east and the north-east into the central river. Early European explorers like the surveyor Mitchell were bewildered by the unpredictable presence or absence of water in this area. Yet even so, settlers assumed that the river consisted of a bed, first and foremost, which could be drawn confidently onto a map, marking out where the river would be at all times, other than in the exceptional circumstances of floods, which really just served to confirm that the 'proper' place of all rivers was within their banks, not outside them.[1] Settlers eventually came to realise that the course of Australian rivers might change. The billabongs, along with the warambools and the gilgais, all suggested the ephemeral and variable nature of the rivers with which they were associated. The local Aboriginal names reveal, as Heathcote[2] has observed, just how unfamiliar this behaviour of water was to the newcomers: they had no words for it in their European languages and had to borrow to name the things they saw. Nevertheless, it was assumed a river had a channel which could be surveyed and drawn, and that this was the rightful way for a river to be defined, instead of by its wayward and capricious behaviour in flood or drought.

This chapter explores the presence and meaning of tanks, sometimes called ground tanks, a strategy used in many of the drier zones of the Inland Corridor to capture and store rainwater in large excavated depressions. The name looks like it is an English word. Yet the word tank is, just like gilgai, from a language other than English. This is not an Aboriginal word. It comes instead from India, where it describes a diverse, widespread and effective range of technologies for managing rainwater. Some were of ancient Harappan origin, in use 3,000 BP, while others were developed under the Mughal imperial administrations in various parts of the subcontinent.[3] The word itself appears to have a double derivation. Its oldest Indian source is either the Sanskrit *taḍaga* or the north-western Gujarati *tank'h*. Its other derivation may have been a word emerging from the very early 16th

century Portuguese encounter with Indians in its southern Indian colonies, in which the Latin word *stagnum* was adapted to indicate the standing body of water which the early Portuguese described as being so typical of the Indian landscape.[4] In either case, it is a word which reflects an association with India which is today even more rarely recognised and acknowledged by Australians than are the tanks themselves.[5]

On the far western side of the Inland Corridor's eastern continental crescent, [see p 6 for an overview of the geography of the Inland Crescent] ground tanks are carefully distinguished from dams which are understood to be, at their simplest, earthworks thrown up as an impediment across an existing watercourse. On the eastern Australian coast, people refer to both these walls across water courses and to scooped water storages as dams; they keep the word tank entirely for free-standing or fabricated containers, including the domestic, above-ground cylinders made of corrugated iron, or more recently, plastic, which store rainwater drained from roofs. Like many people who have grown up on the coast in the mid 20th century, I had never heard the word tank used to refer to an excavation until I travelled into western New South Wales as an adult. Tanks are still common in western NSW, but they are in fact relics of a half century ago. This technique of harvesting rainwater as it both fell and flowed across the landscape was the mainstay of the pastoral industry in the mid 19th century. It had been almost forgotten until the recent bitter debates over irrigated agriculture on the floodplain, then the drought and finally the privatisation of water, reactivated the idea of rainwater harvesting.

This chapter will explore the story of these tanks and the questions arising from their Indian origin. It will consider the way in which technologies are shaped by both the human cultures which generated them and the environments with which those cultures were seeking to engage. The process of transferring a technology across space, time and culture necessarily raises questions about how new technical or mechanical knowledge is apprehended and interpreted by diverse cultural groups and how they apply it, and how it is in turn shaped by the physical and social environments. How, in short, are such

technologies, just like people, plants and animals, 'renatured' in the process of intercontinental and inter-colonial transfer?

Water, workers and flows on the flood plain

Rethinking the Inland Corridor has meant recognising things we may have had in front of us but failed to notice or explore. My research suggests there are four flow-related themes in which we need to practise new ways of seeing. Firstly we need to recognise the more complex ways in which water might move in this country, which takes us far beyond the confidence that rivers belong only within their banks. Secondly we need to *see* Aboriginal people, not only in their pre-invasion relations to water, but in the way water has been involved in each of their roles in the multiple histories of the area and in its present. Thirdly we need to recognise mobile workers across a wider range than we have done in the simple images of the itinerant bush worker. Finally, we need to see the Inland Corridor as a conduit, not only within the borders of the emerging nation which the colonies shaped, but also as a channel connected to the flows of capital, ideas and people around the world. In particular this story brings sharply into focus the *inter-colonial* flows, rather than only the links between European metropole and individual colonies. It was the movements of people, practices and ideas *between colonies*, whether intended and regulated or not, which were of greatest significance in the spread of tank technologies.

While the movement of water and the movement of working people on the flood plain have always been closely related, it is important first to recognise the various ways that water flows on the flood plain. As well as moving within river banks, water moves through the ground, flowing slowly through aquifers, or porous layers of rock sandwiched between non-porous layers. The largest body is the Great Artesian Basin, discovered by bore drilling in 1879 near Bourke on the Darling. While it flows in general towards the Southern Ocean, as does the Darling, it doesn't closely follow the rivers above it. Artesian water flows south in some areas where the Darling is flowing west, and in other areas it is flowing west when the Darling has turned south. Nor does underground water only flow

horizontally, but it moves up and down through cracks in impervious layers. Water, secondly, seeps and stands in the many wetlands which are a part of the Darling River network. These are huge filters which nurture plant and animal life, including extraordinary numbers of migratory birds which rely on the wetlands for breeding. Thirdly, the waters flow across the landscape in many different directions during floods. The floodwater's direction of flow and its colour depend on where the rain which generated the flood fell. If it came down from central Queensland, the Darling's people will tell you, the water will flow dark, but if it came from the western plains the flood will be red. This difference in source will alter the direction of the flood's flow as well, at times pushing floodwater up valleys in the opposite direction to the way it would run if it was coming from somewhere else.

Fourthly, water flows across the surface of the land when it rains, in what is often a very localised shower. Graziers talk about needing to have enough land within their property to 'chase a storm', to respond rapidly by moving stock to the small patches where such local showers can occur with little warning. The movement of water across the surface reflects the almost imperceptible gradients of the land and the diversity of the soils across which it flows. Whether the water moves onwards or disappears, absorbed by the soil, reflects the type of soil, whether sandy, porous red soil which lies slightly raised in fingers of stony ridges, or the cracking clay black soil, deposited as silt in the lower-lying fingers between the ridges by innumerable floods. It is this rainwater which might be harvested in ground tanks, but this requires careful evaluation of the rise and fall of the land, and inevitably experience of how water flows across it in many different kinds of rainfall events, and so the best sited tanks will reflect the most carefully gathered knowledge about how water works in an area.

Finally there are two other ways in which water moves. One, as suggested in discussions about rainwater harvesting, is that it does not always move over land, but instead sinks into the black soil, particularly the cracking clays which hold water deep inside their molecular structure, making this soil prized not so much for its high nutrient content but for its long retention of any small amounts of

water which flow onto it. The last is when water is no longer a liquid, but becomes gas in the intense heat of the region and evaporates to rejoin the rainwater cycle. Evaporation rates are fierce on the Darling flood plain—in the lower Darling, evaporation was 72 inches annually in 1869 and the 1870s.[6]

It has only been recently that underground water was included in calculations of water depletion, as both graziers and agriculturalists became aware of the loss of bore pressure. Consideration of water when it is invisible, either locked within the black soil or as it evaporates, is barely yet on the agenda. Rainwater however, has become the centre of contentious disputes. Acting as if such water did not have to be counted in river extraction, land users had begun attempting to trap rainwater as it flowed across the land's surface, using tanks, dams and channels, to harvest it before it reached the river beds. Such hijacked water reduces the volume of water in river channels and so diminishes that available to downstream users and to the riverine environment, yet because it was not extracted, it did not count against the irrigators' allocation of water they could still pump out of the river. The harvested rainwater could be channelled into the massive storages built up within high embankments by cotton irrigators, which are otherwise filled by pumping from the river. These off-river storages are so extensive that no-one has ever suggested they should be called tanks, they are in fact much more like lakes in their scale and environmental impact. While not yet resolved, this whole debate has turned attention again to the mid 19th century practices of rainwater harvesting and to an investigation of their origins and influences.

If considering the flow of water directs attention to ground tanks, so too does a consideration of the way workers have moved through the Inland Corridor. The main group of people who have often not been 'seen' have been Indigenous people, the large populations of Yuwalaraay, Gamilaraay, Pikampul, Ngiyampaa, Murawarri and others whose country includes the flood plain and all the ways water moves across it. Their traditional stories about living with the flood plain waters suggest an economy and society which was 'flood-dependent' in Rohan d'Souza's terms, organised around a flex-

ible economic and residential pattern which drew benefits from the rise and fall of water, while being prepared to move to accommodate their presence or absence.[7] Yet while recent work in conservation and in water management is prepared to recognise traditional ecological knowledge as if it were a package passed on unchanged from the pre-invasion period, there has been far less interest in considering how Aboriginal people have dealt with the dramatic economic, political and cultural changes of the last 200 years. Aboriginal people have taken an active role in the rural workforce, particularly as long as labour needs remained high, and they have worked as both stock and mechanical workers along the Inland Corridor. At the same time, Aboriginal people were often involved in conflict over water sources even while they were facing ever more restricted access to the plains of their country, increasingly fenced in with locked gates. In consequence, the Aborigines were forced to retreat to the riverbanks which remained open in various forms of public or common arrangement. Even less attention has been given to contemporary Aboriginal mobilisation of water knowledge in deliberate interventions in current debates. Senior Aboriginal people have, for example, taken the decision to be far more assertive in publicising their water knowledge in order to strengthen the arguments being mounted against over-extraction from the river for irrigation or industry.

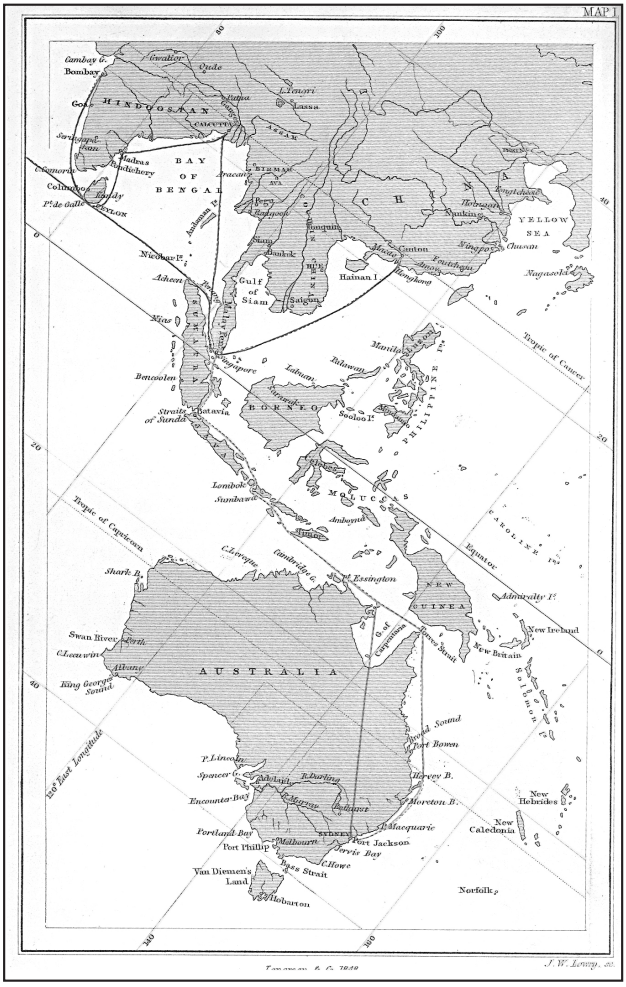
For non-Aboriginal workers, it has been relatively simple to recognise the romanticised itinerant workforces of the 1890s, as Russel Ward did in *The Australian Legend.* Least recognised have been women workers, and among those the Aboriginal women who worked as cooks for shearing and construction contracting teams, the cleaners and domestic servants, the fruit pickers and cotton chippers. But seldom recognised in the Inland Corridor have been the industrial and mechanical workers, like the railway fettlers and the tradesmen and bush mechanics. These workers serviced and managed the machinery used by both graziers and agriculturalists, who in Australia have always been intent on mechanising wherever possible to reduce labour costs, to battle the difficulties of movement in the wet across the black soil plains and to deal with climatic variability by regulating water flow and storage. It is in this group of indus-

trial workers, both Aboriginal and non-Aboriginal, where we find those who either drove the horse teams or later worked the grading machinery or the steam scoops, or who provided the labour for the manual digging, forming up and lining the ground tanks. These are the people whose memories of being tank sinkers, indeed of a whole culture of tank sinking contractors and teams, have kept an awareness alive of this form of water management.

Contesting the Indian Archipelago: Mitchell & Deakin

The suggestion that ground tanks are an indication of a relationship between Australia and India may seem unlikely today—in fact J M Powell assumed that the connection was so poorly recognised that the use of this Indian-derived vocabulary could be no more than a 'visceral acknowledgement of Indian parallels'.[8] The failure to consider Indian sources has been exacerbated by the cartographic depiction of Australia in ways which reflected a sense of being a remote and lonely outpost of European settlement separated by sea, race and culture from all its neighbours. Yet in the early 19th century, the view was very different. NSW Surveyor General Thomas Mitchell opened his 1848 *Journal of an Expedition into the Interior of Tropical Australia*[9] with a map which is startling to 21st century eyes. Mitchell called his map *The Indian Archipelago*, and oriented it along a south-east to north-east alignment which emphasised the sea routes between India, South East Asia and Australia. It showed Australia as a natural and obvious part of the Indian Archipelago by which it was linked to the cornucopia of cultures and traders stretching through Java, the Straits, Malaya and all the way to Calcutta. Despite the focus on England as home for many at the time, it was nevertheless also true that in this period when ships were the only means of overseas transport and communication, India was a close and familiar port as well as a rich trading partner. India may have had an active network of English traders and officials, but there was also for Mitchell an underlying Indian cultural heritage which led him to depict the whole area as an enticing cosmopolitan centre. He pointed out that it had been this Indian Archipelago, including India itself, which was the motive for the great European voyages of exploration '*al nacimiento de la*

especeria', a phrase he translated prosaically as 'to the region where spices grew'. His knowledge of Spanish, built up during his service with the British Army on the Iberian Peninsula, would have meant he was aware of the fertile resonance in this phrase, which speaks of the birthplace or the source of the alluring spices.



The Indian Archipelago.[10] *Courtesy of the State Library of South Australia.*

Alfred Deakin, writing in the 1890s, had a similar view of India's significance for Australia. It is Deakin's writing to which all researchers into water management are directed when they inquire into an Indian connection, because he found it so compelling that he journeyed there in 1890 to investigate, to complement his fact-finding trips to the United States and to Spain and draw lessons for Australian water development. His book *Indian Irrigation* is an important source of evidence for the Indian influence which was to shape Deakin's major role in establishing irrigation in Victoria and along the whole Murray River system. He wrote in his introduction:

> That intellectual give and take which is everywhere a stimulus to thought should be especially quick and prolific between Australasia, or southern Asia, and its northern continent. We are near enough to readily visit India and be visited. Its students might come to the universities of our milder climate, instead of facing the winters of Oxford, Paris or Heidelberg. Our thinkers may yet become authorities upon questions which need personal acquaintance with India and its peoples … Their irrigation systems will be of perennial interest to all hydraulic engineers and especially to those on this side of the line.[11]

Yet this book reveals far more about Deakin's view of Empire and his celebration of the British role in it, than it does about India itself. It demonstrates why it has been so hard to trace the movement of tank technology, for Deakin was in love with British engineers and he really wrote for them. There are many passages like the one quoted below, where he explained not only the extraordinary role in India for the technical knowledge of the English- and Scottish-trained engineers who staffed the Indian Public Works Service from the 1860s, but their social, political and cultural role as well:

> In northern India the engineer is a ruler of men; to him are directed the manifold complaints of irrigators, and the appeals in village disputes; into his hand pour complaints against his subordinates, reports of his officials on petty contractors and labourers, and the

> thousand and one pleas by which all alike seek to make the State their prey … Out of this endless tangle of complications, dealing with many castes and races, each in its own way, and doing rough and ready justice as he goes along among his subject people, most of them willing to corrupt or be corrupted, the engineer emerges into another atmosphere, in which is it necessary for him to address himself to the task of obtaining the sanction of his superiors … Add to this the diplomatic dealing with native notabilities, and perhaps independent princes, villages crammed with ignorant peasants, townships plentifully endowed with fiery fanatics, a host of more or less unreliable native auxiliaries and thousands of helpless ryots who dare not complain of some of the most serious wrongs from his subordinates … It is not too much to say that, after all, the finest product of irrigation in India has been, and is, the gallant company of its engineers.[12]

Deakin focused his book on how Australians could learn from the British in India, rather than from Indian technology or farming, which he described as 'but one remove from savagery'[13] despite his recognition of Indian brilliance in art and metaphysics. Only the British rulers, he argued, had intervened in the cycle of famine by building perennial, reliable canals. Indian farmers, whom he assumed were all Hindus, were described by Deakin either sympathetically as impoverished, helpless and famine-plagued ryots, or contemptuously as slovenly, timid and gossiping.[14] He recognised the ancient Harrapan water engineering in the north-western areas of Gujarat and Maharashtra, but described it as 'all in ruins'. He particularly denigrated the more recent and extensive hydrological works of the Islamic rulers, the Mughals and 'the Mohammaden princes'.[15] In an analysis which says much about Deakin's perception of Australian society, he argued that the most effective indigenous water provision had always been the 'primitive rain-filled tank' of the Hindu ryots, which were dug and maintained within one land holding and which he argued benefited only one farmer and his extended family—a form of primitive individualism. 'Almost every field had its own separate supply, the task of securing and utilising it forming the chief con-

cern of the ryot, and the title to its possession being more important because necessarily implying that to the land which it made fruitful.'[16] He then argued strongly for the introduction of water property rights in Australia, a goal which has only recently been achieved.

Deakin sang the praises of British engineering and the British rulers who brought it to India, arguing that their intervention had brought a complete change to Indian agriculture, it was done with no thought for profit and solely directed to the good of the Indian farmers, to mitigate famine, flood and drought. Yet even in Deakin's work we can glimpse a different way to understand the state of hydrological works in India. In discussing his one use of statistics to show the extent of canal building by the British, Deakin admitted that it was only sutured over the top of a set of indigenous Indian systems of not only tanks, but also canals, which continued to function and which more than doubled the scale of his celebrated British irrigation network. In Madras in particular, the area and the cost of irrigation were markedly reduced because, he conceded, the existing systems were so effective.[17] Almost inadvertently, Deakin's book was an acknowledgement of the extensive and continued utilisation of Indian water management systems.

The imperial narrative that perennial canals had caused an unquestionable advancement in the conditions of Indian farmers, held until contradicted by Whitcombe's 1972 study of agriculture in northern India.[18] More recent works have debated the extent of the change imposed by the British. Agrawal and Narain's *Dying Wisdom*[19] argued that British engineering was the cause of a major decline in traditional systems while Hardiman on Gujarat[20] and Mosse on Tamil Nadu[21] have each countered that change and instability were characteristics of local water management processes before the British. D'Souza[22] contended that it was the new legislative, political and economic structures which forced farmers into using the canal system that generated greater change, than did the engineering itself. Yet for each, the focus was on the Indians involved in their complex roles as either victim or agent. Most assumed a single minded commitment to modernising technology and culture on the part of the British administrators and hydraulic engineers, whether or not they attributed to them entirely

the changes which occurred in the latter part of the century.

But as Deakin revealed in his brief statistical section, Indians had been managing water interactively with the early British East India Company and British colonial administrations for many decades before 1857. Some work allows a glimpse not only of the Indian side of the interaction, but also of the changing British receptivity to local ideas. Benjamin Weil's investigation of a dispute among British staff on the Indus River develops Metcalf's argument that the colonisers drew on different rationalisations to justify their rule before and after the Mutiny.[23] Weil considered the ways in which the arrival after 1855 of modern mentalities of dominance over both nature and colonised subjects, with new British administrators like engineer W Henderson, led to the rejection of the 'native evidence' which had previously been welcomed by British officials to explain flood behaviour. The regime which the British had overseen before the arrival of the philosophical as well as technical influence of engineering had been one in which both local and colonial strategies for water management had operated flexibly in some form of negotiated arrangement, however imperfectly. Weil argued that the approach of valuing local knowledge and of cultivating personal relationships, rather than relying on science and technology, was a characteristic of the early years of British rule and differed greatly from that of the engineers, like Henderson, whose attitudes were much closer to the contemptuous dismissal which Deakin described in 1891. Weil's work is significant for Australia, which was using techniques of water management that looked very like some Indian forms—and was calling them by the Indian terms—from the very earliest days of the British settlement at Port Jackson. We need to look far more carefully at the first half of the nineteenth century when a cohort of English staff and military were much better informed about Indian hydraulic knowledge and techniques than they may have been by Deakin's time.

Ground tanks: the brief dominance of rainwater harvesting in Australia

Our first evidence of the presence of Indian influence in Australia has long been before our eyes but has been little explored. The story of

the first British settlement is always told in light of Governor Phillip's choice of Sydney Cove because of its supply of fresh water which, as Australians know by rote, came from the Tank Stream. This cannot have been its original name, which would of course have been in the Cadigal language and well known to Phillip and the settlers in the earliest months of the settlement as they tried to open lines of communication with the local people. Yet this name seems to have been lost. Instead we know this now buried watercourse only by the name of the dramatic intervention which Phillip ordered to be made within two years of the first landing, as this freshwater steam began to dry up under the pressure of the settlers' uses and one of the worst El Niño events in recorded times.[24] His surveyor of lands, Augustus Alt, oversaw the digging of two tanks in the stream's course to act as reservoirs to conserve the remaining water as it seeped towards the Harbour. These tanks were excavated adjacent to the stream at what is now known as Spring and Bond Streets by being dug into the porous sandstone and lined, allowing the Tank Stream to provide the main water supply for Sydney until 1836.[25]

Why were these excavated reservoirs called tanks, that word of Indian derivation? Why was that word used in Sydney Cove to describe 1790 water storages which had parallels with those (also called tanks in the translation) which were traditionally excavated into the beds of drying streams about which Tagore writes in Bengal?[26] The final answer remains a mystery. Neither of the senior officers responsible for the decision to dig had seen service in India. Alt was a civilian who had worked with the British military in Germany and Governor Phillip, primarily responsible for the decision, was a British naval officer who had not had a land posting. Yet for each of them, the role and experiences of British East India Company staff and British colonial military and officials were well known, circulating as they had been in both popular and military circles for many decades by 1790. Perhaps more significantly, many of the British military officers and enlisted men had seen active service in India. Moreover, the convicts who dug the Sydney tanks may well have included people of Indian background or experience. Working class convicts from the port cities of England like Liverpool may have been drawn from the

substantial Indian communities who had settled there after moving off ships into the land-based population, despite the ferocious Asiatic Articles which had been formulated by the Empire to stop Indian seamen jumping ship and settling in the metropole. Furthermore, there was soon to be transportation from India itself. From at least as early as 1807, and from then onwards for as long as convict labour was used in any of the Australian colonies, there are records of civilian and military convicts transported from Indian ports, many of them English soldiers who had been convicted of military offences while serving in India.[27] Finally the *Australian Dictionary of Biography* names English men, and some women, who had been born or had lived in India, among the early residents of Sydney Cove.[28]

While the earliest senior staff in the settlement may not have had extensive direct Indian service, this changed dramatically with the arrival of Governor Lachlan Macquarie in 1809. Macquarie had served in the British military in India from 1788. He had been based in both Calcutta and Bombay, and had seen active service in many campaigns, including those in the south during the long and gruelling battles against Tipu, Sultan of Mysore. When Macquarie came to NSW he was to replace not only the deposed Governor William Bligh, but also the mutinous and disgraced NSW Corps. To do so he brought the 73rd Regiment.[29] This body of men had served in India since 1781, and although they were transferred from NSW to Ceylon in 1814, they were only the first of a long sequence of British military units with similar histories which came to be based in Australia. Macquarie remained as Governor until 1821, travelling widely along the coast and into the inland once settler crossings of the Blue Mountains became common after 1813. He is recognised as the major force in stabilising the colony's development and in initiating the establishment and then the rapid expansion of its grazing economy west to the Darling River and beyond in the 1830s. This inland movement of graziers was pushing into a landscape which was thought initially to be well-watered, but which soon showed itself to be subject to unpredictable drought. At the time Macquarie's governorship was allowing this initial expansion, a significant proportion of new settlers had had previous experience in India, either as military

officers, traders or administrators, and they were accompanied by convict labourers and later, working class free settlers, some of whom were also familiar with India. Intensive development of the rugged coastal valleys occurred later, with experience diversified further by the influx of gold prospectors in the 1850s, and in higher rainfall riverine environments where the problems were often too much water and water logging, rather than periodic aridity.[30] Knowledge of Indian technologies and certainly the employment of language in common usage in India to describe it, was therefore more likely to be a characteristic of inland semi-arid settlement in this 1813–60s period, than of the better watered coastal expansion of the post 1860s.

The English personnel who had served in India and who came to Australia in the early 19th century had lived largely in northern India. Macquarie's career seems typical; he was stationed for substantial periods in Bengal, based in Calicut, and in Maharashtra and Gujarat, based in Bombay. Like many of the troops in the 73rd, however, he had served in the lengthy campaigns against Mysore, which meant knowledge of southern and south-western Indian water management technology. At least some others associated with NSW in the early years had lived in Madras in Tamil Nadu. They would have been aware of the diversity of forms of tank construction and usage across India.

The collection of water in deep excavations was practised widely across the Middle East and India, and had been from ancient times. The storages in the Middle East were characteristically covered underground cisterns and this type was also used across northern Africa. The Moorish presence in Spain had introduced these deep covered water storages to Spain, where Mitchell would have noticed them. In northern India, the very early storages included the large Harrapan excavations which were lined and left uncovered. While such ancient structures were no longer in use, continuing modifications had occurred in rainwater harvesting systems until the Mughal empire, which further developed not only the excavated water tanks, but also systems of canals to move water from higher tanks to lower and to reticulate it to points where residents could draw from it.[31] Such excavated rainwater storages, known as 'tanks', were in use across the

north-western plains of India when Mitchell and the troops of the 73rd Regiment were there. In Bengal in north-eastern India there were water storages which, rather than being excavations to catch and contain rainwater only, were earthworks thrown up across the flow of existing or ephemeral watercourses, in structures which in English might more commonly be called dams.[32] In southern India, and particularly in Tamil Nadu, the use of tanks to gather surface water was extensively developed, sometimes as separate entities with gravity feed sluices, and at other times with a more elaborate set of canals with existing or ephemeral water courses. Until the mid-20th century, there were estimated to be 39,000 tanks in Tamil Nadu, forming the single largest mode of irrigation in the region.[33]

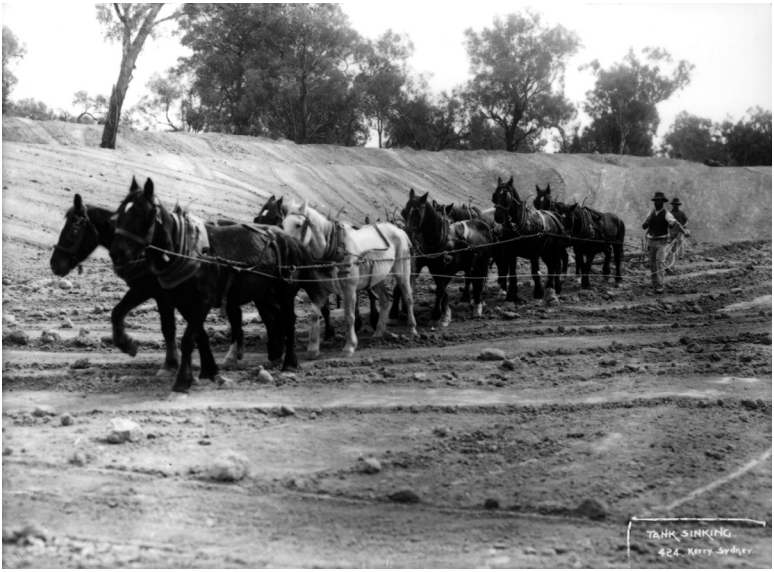
David Mosse's work on these Tamil Nadu tanks and their networks is the most extensive work on Indian tanks. He has attempted to trace the complex ways in which tradition intersected with political mobilisations of power among Indians in their local water management. The British colonial administration sought, as it did with all other systems, to codify and often to 'fix' the existing systems as if they reflected stable and customary systems which could be documented, archived and, preferably, taxed and governed. Mosse pointed out the complexity of the historical context for all such management regimes, arguing that simple custom is neither an adequate nor helpful analytical framework to understand how water was managed before the British, let alone during colonial rule. His arguments no doubt hold true in other areas of India, and for other water technologies, as David Hardiman's study of Gujarati wells demonstrated. Nevertheless, each made clear that the tanks and other water storage systems were set in complex cultural and social knowledge and relationships.

The question when considering the process of transference of knowledge of tanks to Australia is how much of that knowledge might have come to Australia. Had there been significant numbers of Indians in Australia between 1810 and 1860, they might have brought knowledge of either the techniques of tank construction and river behaviour, or of the cultural significance of Indian tanks. Afghanis and other Indians from the north-western provinces who

came with camels from the mid 19th century would have known about the tanks of the plains in Gujarat, Rajasthan and Maharashtra, but they were mostly operating in the more remote and arid zones of central and western Australia, where extreme evaporation rates made uncovered tanks useless.[34] There were some Indians who came during 1788–1860 as servants, labourers and hawkers, but they were few and geographically scattered, unlikely to have been able to effectively transfer cultural or social knowledge of tanks.[35] It seems most likely that whatever was transferred would have come, like the techniques of tank use and construction, with the British themselves.

Ultimately, it was the flow of people and links to international economies intersecting with local conditions which seems to have shaped the way that tanks were adopted and used in the west after that first use in the Tank Steam in 1790. Tank sinking and the use of the word 'tank' to describe a large excavated cavity to hold a sheet of uncovered rainwater, are almost exclusively found in a belt on the western edge of the Inland Corridor's eastern continental crescent: from dry western Victoria, up through semi-arid western NSW, from Parkes and Hillston (but also occasionally as far east as the Monaro) up along the Darling River, including its tributaries like the Gwydir and Namoi, into western Queensland and north into the far inland areas of that state. The term arises in literature of all kinds, from government reports like those of J B Henderson in the 1880s to fiction writing by colloquial authors like Henry Lawson's *Brighten's Sister-In-Law* published in 1889.[36] Tanks were apparently first dug with the convict labour readily available in the period when pastoral expansion was first consolidating in the 1830s, after the initial expansion over the Blue Mountains. However, international depression in the 1840s slowed the rate of flock expansion, and it became clear that convict labour would be ended by the end of the decade. Graziers were concerned about the need to find extra labour to sustain their flocks which needed shepherding in conditions where conflict with Aboriginal people was at its height, predators like dingoes took sheep and water sources were proving unreliable. In the late 1840s, to meet this demand for labour, there was some highly contested importation of small numbers of Indian workers, who may have fostered a con-

solidation of the use of rainwater harvesting in north-western NSW where they worked. The overall labour situation was made even worse with the discovery of gold in 1851, rapidly draining the grazing runs of hands as free workers raced to the diggings. Some of the gap in labour was made up with the rapid recruitment of those Aboriginal land owners who had survived the conflict of the last decade, and they stabilised the industry until workers began to drift back from the gold fields. Then severe drought set in during the early 1860s.[37]



A team of horses sinking a tank or dam. The ten-horse team is hauling a scoop or multi-furrowed plough. The horse team is accompanied by two men, one walking behind holding the scoop, the second guiding the team with a rope. Photograph by Charles Kerry Studio. Tyrrell Collection, Powerhouse Museum, Sydney.

This sequence of labour instability, economic depression and drought meant that rainwater harvesting tanks were even more important in this belt of the Inland Corridor than they had seemed when Macquarie's settlers, with their Indian experience, had first penetrated the inland. Yet the means to establish those tanks, the labour to dig them out, was less readily available in the 1860s than it had been in

the 1820s and '30s. The Indian experience of densely populated rural areas in which tanks were just one thread woven among complex local cultural and political relationships was of little relevance to the long distances and sparse populations of the dry plains in western NSW and Queensland. Under these conditions, settlers turned to building machinery to dig and maintain tanks without the labour which was available in India. Samuel McCaughey, a landholder at Yanco on the western Murrumbidgee River, invented a tank sinking machine during the drought of the 1860s. Known as the 'Tumbling Tommy', it cut the cost of constructing tanks by 60% to 70%.[38] More powerful still were machines running on steam, the steam scoops which began to be put into use to sink rainwater tanks in arid western Queensland by the late 1870s. The Queensland government moved to address the problem, which was by then being debated by the eastern colonies, of the need to appoint a hydraulic engineer to address the management of their variable and fragile water resources. Queensland appointed J B Henderson, a Scottish-trained engineer with no Indian experience, but who took up work when rainwater harvesting by ground tanks was well established and seemed to be the only way that the western districts could combat their recurrent water crises.

Henderson began his first inland survey trips in 1883 with this view, carefully distinguishing between tanks and wells and including in his report long lists of the tank work being undertaken, detailing the large capacity of the existing and planned tanks, and noting the new excavations, the number of tanks being cleaned out to maximise their capacity, and the deployment of the new steam scoop machines to try to hasten the pace of work.[39] In the shadow of recent severe droughts, increasing the number of tanks was urgent. Henderson concentrated his report on how best to do this, reporting constant problems of labour shortages, which had now become complicated by interruptions due, ironically, to localised flooding after unexpected rain. His only hope other than pressing ahead with more tanks was boring for underground water, which had recently yielded spectacular results at Bourke on the Darling in western NSW. In retrospect it is apparent that the events of 1878 marked the discovery of the Great Artesian Basin, but it was not at all evident even by 1883 that

the Bourke results were not simply an anomaly and that they could be replicated in other areas. Henderson reported pessimistically that boring attempted in western Queensland had not proved satisfactory and could offer no promise of relief from water scarcity. Tanks appeared to be the only way forward.[40]

By early 1884, Henderson had shifted his position for two reasons. The most important overall was the severity of the resurgent drought which, by January 1884, was being felt in all parts of the colony. 'An immediate water famine appeared inevitable', Henderson wrote, 'with urgent and pressing appeals for speedy relief' being made by all.[41] Tanks were still clearly of major significance in all the areas on which he reported, but continued excavation was now being obstructed by the extreme water shortage which meant that water for people and draught animals, and ironically, the water needed for the operation of the steam scoops, was not available. The combined labour and climatic problem was forcing him to look at alternatives.

> To my mind, the drought has shaken a good many arguments urged in favour of depending upon tanks for a permanent supply of water, unless, perhaps, they are of exceptionally large capacity and very deep in good imperviable [sic] strata, but unfortunately tanks of this type would be very costly even if the latter conditions could be obtained, which, however, is not often the case[42]

Into this worsening situation, the element of hope emerged from the unexpected success in locating underground water achieved in two of the bores which Henderson had initiated. Now, finally, the promise of permanent water intimated by the Bourke wells in 1878 began to look as if it if might be fulfilled. Henderson announced that he was now: 'turning a larger measure of attention … to vigourously prosecuting boring on a larger scale'. [43] Still struggling with water shortages, he saw bore drilling as a less labour-intensive and less climate-vulnerable way to secure urgently needed water.

The Great Artesian Basin did indeed allow unexpectedly extensive watering points across the driest eastern and central sections of the Inland Corridor and Henderson's work became ever more ori-

ented towards the boring for and management of artesian water. Yet bores were not successful everywhere. The aquifers were too deep, or the water when it bubbled up was too saline to be useable for humans, stock or agriculture. For these areas, tanks continued to be essential. Henry Lawson wrote about how bushmen could set up as tank sinkers with minimal capital, but the life was remote and harsh. Itinerant workers might be readily found in the big depressions of the 1890s and 1930s, but it was increasingly the case that capital intensive machinery, not labour intensive methods, were used to dig the tanks. Big engineering companies like British Standard Machinery produced the machines to do this and advertised their products to Australian audiences with appeal to the enormous scale and precision construction methods of the craft in rural NSW and Queensland.[44] Yet it has been the working people, the bush labourers Lawson wrote about in the 1890s, the elderly Aboriginal and grazing people I have interviewed, and the small contractors like Tom Kruse, the famous Birdsville mailman who retired to set up as a tank sinker in 1953, who have maintained the memories of the work and of the methods of tank sinking.[45] What they have not retained at all is the recollection, beyond the word tank itself, that this technology was based on centuries of Indian strategies for water management.

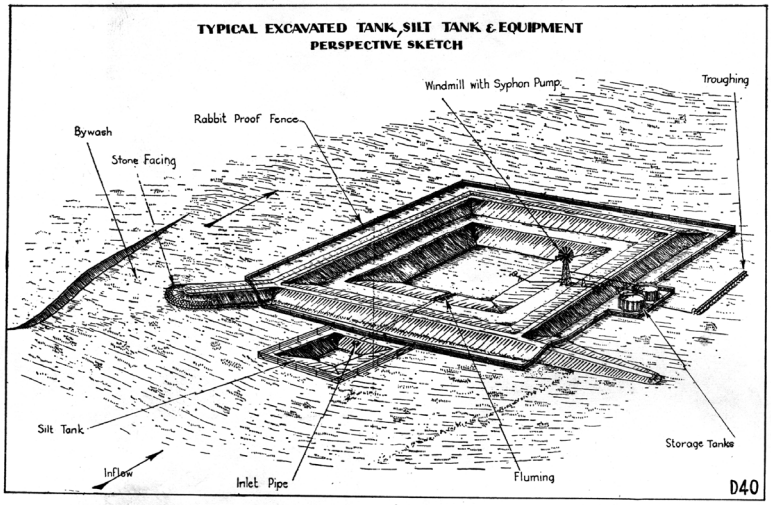
Intercoloniality: problematic flows of ideas

In reflecting on the puzzle of how Indian technology could be transferred to Australia but its source forgotten, it is important to consider the possibility that Indians themselves brought the knowledge and the techniques. Yet although there were more Indians here as workers, servants and traders than is usually acknowledged, it is most likely that the major period of transfer of knowledge about tanks was the early 19th century, when there were still few Indians in Australia, rather than the later years of the century, when greater numbers of Afghanis and Sikhs were settling in rural areas. Nor were those who were in Australia in the early decades of settlement living in concentrated situations where their collective knowledge might make popular the concept of tanks. While the presence of dispersed Indians in the early 19th century may have influenced the use of the language

of tanks, they were unlikely to have brought in the strategy of constructing them. It is far more likely that, building on the initial use of tank technology in 1790 on the Tank Stream, the basic knowledge of tanks as rainwater harvesting and storage technologies continued to be brought and implemented by the many British settlers with Indian experience. This would have been of particular importance after 1810 when the 73rd Regiment had arrived to serve with Macquarie, and then after 1813 when the Blue Mountains crossings escalated, and on into the 1860s when severe drought afflicted the western grazing lands and demonstrated the urgency of water harvesting. Although British engineers had a far greater influence on both India and Australia after 1860, the use of tanks in Australia was soundly established and consolidated in the period before the full impact of modern engineering, so celebrated by Deakin. Only after 1860 did the methods of engineers begin to be turned to tank sinking in Australia, transforming its techniques, in a way which was less often the case in India, where tanks instead were marginalised by the very different systems of perennial canals and annual taxation regimes.

The early English settlers who brought an awareness of tanks to Australia, whether from military, civil service or missionary backgrounds, had been living in India in a period when they may, following Metcalf's analysis, have been more open to noticing and appreciating Indian methods of dealing with difficult environments with which the English were unfamiliar. They may even, although this is less certain, have had some knowledge of the cultures which had developed around tank construction and use in India. Yet the conditions in Australia into which this technical or cultural knowledge might have been drawn were very different from those experienced by the British in India. Despite the fervent desires of both administrators and settlers, the hopes for a closely settled rural Australia continued to be disappointed. Even in the times of greatest colonial population, most settlers lived in coastal areas and there were never dense populations in any area on the inland plains where rainwater harvesting tanks were practical or necessary. There was little possibility of social networks or cultural associations developing around newly excavated

tanks in the way that might have happened in India with long established water sources and large dependent populations. Nor did the tanks immediately develop the complex nature or depth of the narratives which bound people with water sources in local indigenous cultures, as they did for example around the mound springs in far north-western NSW. So, perhaps ironically, the conditions accompanying tank construction and usage in Australia offered less possibility for complex collective meanings and were far more like the individualistic ownership and use which Deakin had imagined to be the case in India. There was little surviving interest therefore in the complex cultures which surrounded Indian tanks, only in technicalities of design and construction. And in time as labour shortages worsened, the necessity of machine construction made the process of tank sinking into something which looked, as the British Standard Machinery Company boasted in 1953, much more like the modernities of British engineering and hydrology than had ever been the case in India when Deakin was writing about what he saw as a stark divergence between the 'savagery' of 'primitive' tanks and the glories of British canals.



From the original plan by N.S.W. Water Conservation & Irrigation Commission.

Typical excavated tank, silt tank and equipment.[46]

Bores had in any case superseded tanks in many areas by the turn of the 20th century and their artesian water seemed inexhaustible, so endless that it was allowed to flow unfettered and evaporating from uncapped bores and along open bore drains to allow stock to drink and crops to be watered. Such unprotected openings to the unseen reservoir underground meant that it has been increasingly subject to pollution by spray drift from agricultural chemicals. The combined losses from evaporation and the massive drain on the underground reservoir as bores on the Great Artesian Basin multiplied exponentially have taken their toll and the depletion of the supply is evidenced by the major loss of pressure now being measured across the Basin. At the same time, there was the onset of the longest drought in recorded history across most of Australia, expected to be exacerbated by global warming. Under these conditions, rainwater harvesting has begun to look interesting again, and it is here that we can begin to search not only for its Australian history, but also for its passage into and through the Inland Corridor from the Indian Archipelago. Transmitted by both Indians and Englishmen, this was an idea which was only poorly understood by many of its carriers, and whose technology was changed almost beyond recognition by its new circumstances. Just enough traces remain in words, habits and memories to allow us find its Indian histories and cultures.

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