

Rachel Carson Center Perspectives

How to cite:

Lawrence, Susan, and Peter Davies. "Liquid Asset: Water in Victorian Gold Mining."
In: "Visions of Australia: Environments in History," edited by Christof
Mauch, Ruth Morgan, and Emily O’Gorman. *RCC Perspectives:
Transformations in Environment and Society* 2017, no. 2, 71–79.
doi.org/10.5282/rcc/7910.

RCC Perspectives: Transformations in Environment and Society is an open-access publication. It is available online at www.environmentandsociety.org/perspectives. Articles may be downloaded, copied, and redistributed free of charge and the text may be reprinted, provided that the author and source are attributed. Please include this cover sheet when redistributing the article.

To learn more about the Rachel Carson Center for Environment and Society, please visit www.rachelcarsoncenter.org.

Rachel Carson Center for Environment and Society
Leopoldstrasse 11a, 80802 Munich, GERMANY

ISSN (print) 2190-5088
ISSN (online) 2190-8087

© Copyright of the text is held by the Rachel Carson Center.

Image copyright is retained by the individual artists; their permission may be required in case of reproduction.

SPONSORED BY THE



Federal Ministry
of Education
and Research

Deutsches Museum 



Susan Lawrence and Peter Davies

Liquid Asset: Water in Victorian Gold Mining

The Australian colony of Victoria hosted one of the world's great gold rushes during the nineteenth century. Gold was discovered in central Victoria in 1851, only three years after the Californian rush, and the colony's gold output rivalled that of California for the rest of the century, producing 2,300 tonnes of gold by 1914. There remain many untold stories of gold mining in Victoria, but perhaps one of the most surprising is the intimate relationship between gold mining and water supply. As an industry, gold mining depended on steady and abundant supplies of clean water, yet Victoria is a relatively dry region in the driest inhabited continent. Rainfall ranges from 450–800 mm per annum on the goldfields but surface water is scarce. Lakes and ponds are rare, and rivers are small by world standards. To get the water they needed, miners had to devise ways of storing it and diverting it to their claims. Victorian miners confronted the unique challenges of the Australian environment and developed responses that continue to make Australian water management distinctive in the world today.

Gold miners invested hundreds of thousands of pounds in infrastructure to secure water supplies, some of which are still in use. In the process they redefined water as a commodity, established principles of water regulation that underpin modern Australia's multibillion dollar water industry, and created consequences for the environment that are only now being understood. Unravelling the environmental history of water in Victoria's mining industry starts at the small scale, explaining the presence of fragmentary archaeological evidence of water channels and dam walls. It connects local places into networks of technology and social relationships up and down river valleys and across mountain ridges into neighbouring watersheds. It replicates those networks across the colony, wherever the presence of gold drove miners to harness water for their



Figure 1:
Map of central
Victorian goldfields.
Source: the authors

needs, using it to sluice gold from the wash-dirt. Stepping back, it considers how those long-ago actions continue to influence modern society and the land we live with.

Local Places

Our starting point is the dry eucalypt forest along central Victoria's mountainous spine. This is where the richest gold was worked and where abandoned mine shafts and crumbling stone cottages can still be found. Winding among the shafts and footings are small ditches (known locally as "races") up to two meters across and one meter deep. They are usually filled only with leaf litter and fallen branches, but even now after heavy rains they sometimes still carry water. Generally these ditches attract little attention because they appear small and inconsequential and seem to go nowhere in particular. Sometimes the ditches start or end at the mounded earthen wall of a shallow dam. The reservoirs too are usually empty and far less interesting than ghost towns and industrial heritage. It turns out though that these ditches and dams, these picnic spots and jogging tracks, are the beginning of something much larger.



Figure 2:
Eucalypt forest near
Creswick, Victoria.
Photo by the authors.

Mining ditches were built by numerous parties on the goldfields and were often the source of legal, verbal, and physical hostilities as water supplies ran short. Chinese miners were frequently at the centre of such disputes, accused of cutting races and pilfering water. A good example of a water race is the

one built by John Boadle Bragg, an Irish-American miner at Creswick in central Victoria. Bragg and his partners in the Humbug Hill Sluicing Company needed water to work their claim. In 1856 they secured one of the early water rights in Victoria and started building an extensive network of ditches and reservoirs. By 1859 they had spent £1,000 constructing a reservoir that could hold up to 90 million litres of water, and had built an 11 kilometre ditch to their claim at Humbug Hill. Bragg saw the chance to make money

from water as well as from gold, and he urged his seven partners to extend the ditch a further 10 kilometres west to the Bald Hills, where water could be sold to other miners. Not all of them agreed with him, however, and in 1860 the eight partners appeared in court after their arguments turned into a vicious brawl. Eventually, Bragg and his supporters bought out the dissenters and work continued. By the time the water reached customers at the Bald Hills in 1862 at least another £3,000 had been spent on an innovative (and unsuccessful) system of paper pipes coated with bitumen. Bragg died in 1865 but the company continued sporadically until 1880, when its water right and other assets were taken over by the local council and incorporated into the town's municipal water supply. Modified in some places, abandoned in others, much of what Bragg and his associates built in the 1850s and 1860s remains intact in the Creswick State Forest.

Bragg's other legacy is the system of water right licenses that he and others like him fought to establish. From the early 1850s miners began claiming water, building the infrastructure to manage it, and fighting to retain control of it. Mining wardens and local courts gradually responded and by 1865 the ragtag collection of local custom and regulation in each Mining Division had been codified under provisions in the *Mining Statute*. The *Statute* combined elements of the British tradition of riparian rights, where water belonged to those who owned the adjoining land, with the new California Doctrine of appropriation emerging from the American gold rush, where water belonged to those who first claimed it. In the new Victorian system, water belonged to the Crown but rights to it could be leased for periods of up to 15 years. The water right or license permitted water to be bought and sold along with the infrastructure that delivered it. Miners and the new class of water merchants had security of tenure for the period of the licence, while the Crown retained ultimate control. In the 1880s the colonial government, looking to establish irrigation for agriculture, completed the process of nationalising water and borrowed the miners' water rights system to license irrigators. Today's pattern of state and federal government control over water licences and entitlements had its origins on the goldfields of Victoria.

Valleys

With secure legal access to water, miners were able to manage river flows along entire valleys. John Pund, a gold miner near the town of Beechworth in northeast Victoria,

used the system established by pioneers like Bragg and his peers to make a fortune. Starting in 1865, Pund began acquiring mining claims and water licenses in the Three Mile area. Eventually his race network extended 28 kilometres from the source of water in the springs around Stanley to his claim at Three Mile, and when he died in 1915 Pund left an estate worth £16,000, having amassed 24,000 ounces of gold in his career. Pund's success was entirely unremarkable around Beechworth, where he was one among many and by no means the foremost.

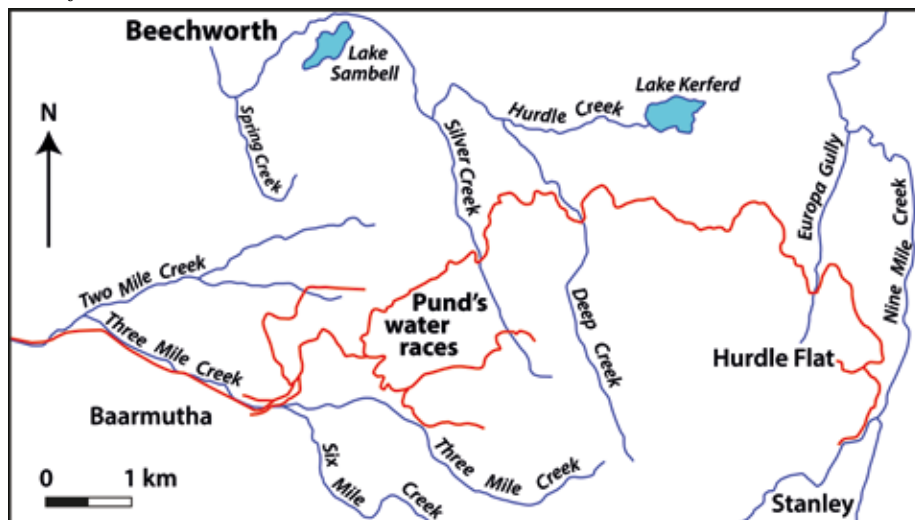


Figure 3:
Plan of John Pund's
water race system
near Beechworth,
Victoria.
Source: the authors

Unusually for Victoria, many Beechworth water licenses, including Pund's, tapped underground springs (i.e., groundwater) in addition to collecting rainwater in reservoirs (i.e., surface water). They were able to access enormous volumes of water. Pund held licences to divert more than 6 million litres per day by the 1890s, enough to fill three Olympic swimming pools, but a small amount compared to those of others in the district. Some held licenses entitling them to 8 million, 20 million, and in one case up to 320 million litres per day. By 1884, there were 75 water right licenses issued in the Beechworth district, capable of supplying more than 500 million litres per day between them—an amount of water that today would supply the domestic needs of a city of several million people. Pund's claim at Three Mile was on a tributary of Hodgson Creek, but the water he used to work it came largely from the Upper Nine Mile Creek. Nine Mile is part of an entirely different river system, draining north into the Kiewa River, while

Hodgson Creek flows west into the Ovens. This means that Pund, like many of the other Beechworth water bosses, was carrying out major and significant water diversion between catchments. Spring water flows in Pund's races today, still running west into the Ovens instead of north into the Kiewa.

Pund's influence on Hodgson Creek did not end with the delivery of millions of litres of extra water, nor with the work at his claim. Once he and the other sluice miners had used the water, they released it back into the nearest creek or gully, where it carried vast quantities of sediment downstream from their diggings. At the time, "sludge" was defined only by its sediment load. Concerns about chemical contamination, including potentially mercury, arsenic, and cyanide, were not raised until well into the twentieth century. In Pund's case, the sludge flowed a further 30 kilometres downstream to Tarrawingee, where the sludge spilled out of the channel and across the floodplain, covering ten thousand acres of prime agricultural land. The local council channelised the creek in the 1880s in the hope of controlling the damage, but to no avail. Even the passage in 1904 of anti-sludge legislation that required Pund and all the other miners in Victoria to build tailings dams to contain their waste on site was of limited effect. Farmers on the plains were still protesting about sludge in 1917, by which time Pund's son had taken over the operation. Today erosion in the creek at Tarrawingee has cut down through the old layers to reveal 1.5 metres of Pund's sludge lying above the original ground surface.

Colonial Landscapes

Pund and his fellow water merchants at Beechworth controlled the way that water ran in their local catchments, Hodgson and Woolshed Creeks. They moved water into the valleys from elsewhere, diverting it into and out of the creeks at will. They used water to change the contours of the valleys they mined, polluting the water with sand, gravel, and silt, and discharging their waste to reshape the distant plains. All over the colony, miners and water merchants used water in similar ways to reshape other river valleys. Gold was widely distributed in Victorian rock and soil, with 75 per cent of the colony's major river catchments having mines somewhere within them. This set the Victorian experience apart from those of California, the Klondike, and New Zealand where gold was concentrated in a few major rivers and the environmental impact of sludge was similarly concentrated.

The impact of mining on so many of Victoria's rivers did not go unnoticed. Beginning in the 1850s those affected by mining sludge, including shop owners, publicans, and farmers, began to complain. Councillors in goldfields towns were forced to raise road levels and continually replace bridges. Vineyards, orchards, and market gardens were inundated in the immediate vicinity of the towns, and even 60 kilometres downstream sludge flowed out over pastoral properties and made water undrinkable. Numerous royal commissions and government inquiries were held, the first in Bendigo in 1859, followed by a colony-wide inquiry in 1887, and another in 1914. Mining interests were powerful in Victoria, however, where gold was the major export industry well into the 1880s, and it was only with the decline of the industry early in the twentieth century that legislation was finally enacted that curbed the worst effects of sludge.

By then, though, the damage had been done. Bendigo's alluvial miners had sent clays and silts downstream to settle in a thick layer that covered 700 square kilometres of grazing land. The stamping mills that crushed quartz from the mines in Ballarat had choked the Yarrowee/Leigh River for 60 kilometres downstream. Hundreds of millions of tonnes of soil had been dislodged and sent into rivers in northeastern Victoria, and sludge 1.5 metres thick covered the river flats below the mines at Castlemaine and Daylesford. Even at the end of the century, when mining was in decline, the sludge continued to move downstream. It settled in the new irrigation reservoirs being constructed for agriculture, raising base levels by three metres in just over a decade.

Today

The effects of the miners and their thirst for water are still felt in many ways, large and small. Mining sludge remains in the river channels, working its way further downstream as sandbars in each flood event. These scour the river beds that provide habitat for plants and insects and fill the pools that shelter the fish. Sludge is also still present on the floodplains, forming a hard crust that inhibits the growth of plants. Scientists have many terms for the soil that has washed into New World waterways as a result of land clearing and agriculture, "post-settlement alluvium" and "legacy sediment" are two, but the proportion that has come from mining in Victoria is only now being documented. The re-contouring of rivers and the reshaping of floodplains by miners around the world—in

California, the Klondike, and New Zealand in the nineteenth century, and in many developing countries today— is a permanent, widespread change to the Earth's surface that is a marker of the Anthropocene, an age in which the impact of humans on the surface is so profound that it creates its own geological epoch.

Other effects are more positive. The infrastructure built by the miners, for example, still helps deliver drinking water to regional Victoria. Anti-sludge legislation was the antecedent of further Victorian laws to protect the environment and make polluters responsible for the damage they caused; strong environmental legislation engendered by mining continues to protect Victorian waterways. Legislation and practice that have their origins in mining also underpin the allocation of water across much of inland Australia. The Murray-Darling Basin Authority allocates water licenses over an area covering one-seventh of Australia, sharing water between upstream cotton growers in southern Queensland at one end and the one million people living in the city of Adelaide at the other. People still make fortunes buying and selling water licenses in a market that is now worth billions of dollars annually.

Significantly, environmental flows that divert some of the water for the health of rivers and the ecologies they sustain are now embedded in Australia's water allocation scheme, which is one of the most sophisticated and successful water-sharing systems in the world. Environmental releases are often held back in dry years, however, when the rivers need them the most. Of equal significance is the flexibility provided by public ownership of water. The Victoria government actively encourages homeowners to collect rainwater as part of the strategy to use water sustainably in the face of climate change and increasingly severe droughts. This is in stark contrast to parts of the American West, where the mining doctrine of prior appropriation is still in effect and makes it illegal for homeowners to collect more than a few hundred litres of water from their own roofs.

Mining continues to be an important part of the global economy. While mining in some parts of Australia is governed by strong regulations that ensure protection for the environment, this is not the case everywhere, especially in the developing world where most modern mining takes place. Victoria's experience more than 100 years ago offers an important historical perspective on the environmental impact of mining and on potential solutions to the challenges that mining brings. Miners adapted traditional meth-

ods to the unique conditions they encountered, dramatically transforming soils, plants, streams, and entire landscapes, leaving scars that can easily be read today. A century after mines stopped pumping sludge into Victoria's rivers, most of them are sufficiently recovered that they are aesthetically pleasing amenities to their communities. One hundred years is a long time to wait, however, and it is not yet enough to fully restore the aquatic communities the rivers once hosted. It took Victorians 50 years to learn to control sludge, but there is no need for other countries to take so long.

Further Reading

Davies, Peter, and Susan Lawrence. "A Mere Thread of Land: Water Races, Gold Mining and Water Law in Colonial Victoria." *Journal of Australian Colonial History* 16 (2014): 168–87.

———. "Mercury Use and Loss from Gold Mining in Nineteenth-Century Victoria." *Proceedings of the Royal Society of Victoria* 127 (2015): 44–54.

Davies, Peter, Susan Lawrence, and Jodie Turnbull. "The Archaeology of Anthropocene Rivers: Water Management and Landscape Change in Gold Rush Australia." *Antiquity* 90, no. 353. (2016): 1348–62.

———. "The Sludge Question: The Regulation of Mine Tailings in Nineteenth-Century Victoria." *Environment and History* 20 (2014): 385–410.

Isenberg, Andrew. *Mining California: An Ecological History*. New York: Hill and Wang, 2005.

Kanazawa, Mark. *Golden Rules: The Origins of California Water Law in the Gold Rush*. Chicago: The University of Chicago Press, 2016.

Lawrence, Susan, and Peter Davies. "Cornish Tin-Streamers and the Australian Gold Rush: Technology Transfer in Alluvial Mining." *Post-Medieval Archaeology* 49, no. 1 (2015): 99–113.

Morgan, Ruth A. *Running Out? Water in Western Australia*. Crawley, WA: UWA Publishing, 2015.

Morse, Kathryn. *The Nature of Gold: An Environmental History of the Klondike Gold Rush*. Seattle: University of Washington Press, 2003.

O’Gorman, Emily. *Flood Country: An Environmental History of the Murray-Darling Basin*. Collingwood: CSIRO Publishing, 2012.

Powell, Joseph. *Watering the Garden State: Water, Land, and Community in Victoria 1834–1988*. Sydney: Allen & Unwin, 1989.

———. *Plains of Promise, Rivers of Destiny: Water Management and the Development of Queensland 1824–1990*. Brisbane: Boolarong, 1991.