Pioneers of goldfields water management: the Lal Lal Waterworks Association

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Alluvial gold mining in the 19th century demanded large volumes of water to separate gold from the washdirt. Miners excavated extensive networks of races and dams to bring water from where it was available to where it was needed. Entrepreneurs saw the opportunity to capture and monopolise water supply and sell the water to miners at a profit. The Lal Lal Waterworks Association was created in 1858 and secured the first water right licence issued in Victoria, to deliver water to miners on the Moorabool goldfield south of Ballarat. The system included six dams and almost 100 km of races but ultimately it failed to deliver as promised. Examination and mapping of the extensive archaeological remains indicate the scale and ambition of the enterprise and reveal some practical reasons why it was unsuccessful.

Keywords: mining, landscape archaeology, water supply, Victoria

Introduction

Despite decades of research on the archaeology of mining in Australia and New Zealand it is only in recent years that archaeologists have begun to systematically analyse some of the most abundant features found on mining sites: the evidence of water infrastructure. Subtle ditches, mounds and surviving dams occur on most goldfields but lack the drama of other kinds of mining features. They are not as obvious as the remains of ruined machinery or buildings and not as extensive as the large scars left by sluicing and mullock heaps. Moreover, water infrastructure often extends beyond the margins of an individual mine site with the evidence at any one location appearing to be slight and inconsequential. Supply dams are potentially many kilometres away and are only connected to mining locations by lengthy, often fragmentary ditches. Despite the minimal visual impact of such features, Carpenter (2012:12) has claimed that ‘water races are the most significant heritage of alluvial goldfields’.

Recent archaeological work is now demonstrating that water played a key role in facilitating the development of mining in Australasia. Water is necessary for processing minerals of all kinds but climatic conditions mean it is particularly scarce on many Australasian goldfields. Most of Australia has relatively little permanent surface water in rivers and lakes and rainfall tends to be low, highly seasonal, or both. The Otago goldfields in New Zealand have large snow-fed rivers but the climate is relatively dry. In this context securing sufficient water to process the washdirt was a vital part of successful mining throughout the region. Supplying water for mining led to the emergence of a thriving water industry and the engineering skills fostered were readily transferred to the provision of water for municipal supplies and later irrigation agriculture. The need of miners for water has been previously under-recognised by historians so archaeological evidence in this area is now making a significant contribution to our understanding of mining, water, and historical environments.

In this paper we provide a case study of how the archaeological evidence of one water supply network has revealed both the opportunities and the risks in investing in water. The gold rush provided an opportunity not only for miners to seek their fortunes but for capitalists to invest and expand their wealth. An important avenue for goldfields investment was in the construction of races and dams to supply water to miners and their claims. Construction and maintenance of mining water systems demanded large sums of money, often thousands of pounds, but the profits could be substantial if the goldfield was rich and environmental conditions allowed the capture and diversion of sufficient water. The case of the Lal Lal Waterworks Association (LLWA) provides an early example of a corporate, commercialised water scheme in colonial Australia, where an environmental resource was manipulated on a substantial scale to create a local monopoly on water supply. The scheme was initially successful but within a few years it struggled to meet the needs of miners on a ‘poor man’s diggings’. Archaeological and historical evidence reveals a range of environmental, legal and structural problems that resulted in the ultimate demise of the scheme.

Environmental and historical context

The LLWA was one of many examples of investors becoming involved in water supply schemes in the expectation of large profits. In north-east Victoria, for example, mining entrepreneurs such as John and Peter Wallace invested heavily in various water supply systems from the 1850s to the 1890s (Lloyd 2006; Woods 1985). Backers of the LLWA sought to exploit the Moorabool goldfield south of Ballarat. Following its establishment in 1858 the LLWA developed an extensive infrastructure of dams, races, tunnels, cuttings and flumes to capture and distribute water from Lal Lal Creek, a tributary of the West Moorabool River. The system was unlike contemporary mining water networks on other goldfields because the Association dominated the delivery of water and effectively excluded other parties from competing in water supply. The system was also of great interest to municipal authorities in Geelong and Ballarat, which were exploiting increasingly remote water sources in this period to meet growing domestic demands.

The LLWA was established to serve mining interests but it was dominated by men who were not themselves goldminers. The original twelve members included Scottish-born pastoralists Archibald Fiskien and John Hardie Fairbairn, engineer

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William Standring and excavation contractor George Hunt. Water for the partners was a business opportunity, a chance to apply their capital and other resources to exploit a natural resource vital to the mining industry. This entrepreneurial approach sought to make money from the labour of miners rather than from direct engagement in mining itself. Despite the opportunity to profit from the needs of miners the LLWA faced a range of problems and setbacks over the years that saw the members give up the licence over the race system around 1874. It then came under government control and was later leased out before the main storage dam was destroyed in the late 1880s and the system fell into disuse. Extensive archaeological remains reveal the scale of the network as well as its limitations.

The investors sought to exploit the water of Lal Lal Creek, one of several watercourses that rise in the Great Dividing Range around Ballarat and flow south towards Geelong. Others include Yarrowee Creek (Leigh River) and the West and East branches of the Moorabool River. Lal Lal Creek, a major tributary of the West Moorabool, emerged from Beales Swamp in the Bullarook (or Wombat) Forest, the latter formerly an extensive tract of forest country that extended many miles along the Dividing Range (Houghton 1980). Lal Lal Creek flows south to join the West Moorabool near the township of Lal Lal. Dolly’s Creek and Tea Tree Creek join the West Moorabool further downstream. The spectacular site of Lal Lal Falls, a short distance below Fiskens’ dam, received protection as a scenic reserve in 1865 (Clark 2002:48). The Lal Lal blast furnace, also a well-known industrial site in the region (Jack and Cremin 1994), appears to have had no relation to the waterworks scheme.

The climate of the catchment is temperate, with average maximum temperatures ranging from 24°C in summer to 11°C in winter. The average annual rainfall at Morrisons, the mining settlement at the end of the race network, is 657 mm (Bureau of Meteorology). This area is in the southern part of the Central Victorian Uplands bioregion, with gullies dissecting the steeper slopes and ridges. The granitic and sedimentary terrain is dominated by Grassy Dry Forest (EVC 22) and Grassy Woodlands (EVC 128), much of which has been cleared for agriculture (DELWP, Bioregions). The LLWA study area is a mosaic of private bushland and open farmland, along with state forests and conservation areas. Streamflow gauging on Lal Lal Creek, measured between 1978 and 2016, showed significant seasonal variability, with monthly summer flows typically discharging <50 megalitres (ML) while volumes in winter peak during August and September at several thousand ML per month (DELWP, Rivers and Streams).

Payable gold was first announced at Dolly’s Creek in early 1857. Soon after gold was also discovered nearby on Tea Tree Creek and on the property of squatter Hugh Morrison. Together the three settlements were known as the Moorabool diggings (Flett 1970; Lawrence 2000). The population peaked in 1861 with around 700 people but the rush passed quickly, leaving only a handful of people on the field by the 1870s. By the 1880s activity had shifted to deep lead mines along the banks of the Moorabool River at Morrisons and to quartz reefs near Elaine, west of Dolly’s Creek. Settlement at Elaine and Morrisons continued into the twentieth century but Dolly’s Creek was almost entirely abandoned by 1883 when much of the area was gazetted as a timber reserve (Government Gazette 3 August 1883:1757; Lawrence 2000:34; Royal Commission 1885:204, Q5392).

Origins and development of the LLWA

The LLWA was registered as a limited liability partnership under the Mining Association Act 1858 with £3500 capital in 100 shares of £35 each. By this Act shareholders in a company were not to be held liable for the company’s debts beyond the amount of their shares (Smyth 1980:393). Dickers’ Mining Record observed in October 1863 (p. 220) that the initial capital of the LLWA had never been enough to complete the proposed scheme, especially given the need for expensive tunnelling and fluming. The journal argued that had the full cost been known it was unlikely the partnership would ever have eventuated.

The race and dam network created by the LLWA owed a great deal to early survey and construction work by George Hunt, William Standring and William Rowbottom. Beginning in 1860 they spent several months surveying among the hills and gullies with the initial view of diverting water to Geelong. Their attention soon shifted, however, to supplying the Moorabool diggings where water was in short supply and generally located well below the level of mining operations (e.g. Geelong Advertiser 3 May 1857:3, 9 Feb. 1863:3). Hunt built two dams, including one beside the property of Mr R. Connell near Mount Doran, which became the main distributing point for the LLWA system (Royal Commission 1885:197). This dam remains in private use today.

The first recorded water race on the Moorabool belonged to Mr Buxton and party, who applied to the Mining Warden in September 1859 for a permit to cut a 3 mile race from Lal Lal Creek to the Moorabool diggings (Geelong Advertiser 15 Sept. 1859:3; Lawrence 2000:81). In 1861 the LLWA sought a water right grant from the Mining Registrar at Ballarat to take 30 sluice-heads (almost 6½ million gallons or 29.5 million litres) of water daily from Lal Lal Creek. The following year they applied successfully for the very first water right licence issued in Victoria under the Amending Act 1862 (Government
was transferred to the Department of Kirk in 1857. Ownership of the dam monger Creek by American miner John acre (6.9 ha) reservoir built on Fell-mining water in the district was a 17- substantial enterprises for supplying keepers in the forest. One of the most guarded and maintained by race

Once constructed the races were (30 km) long (586; 818–819). The legal permissions for which the LLWA applied in 1861 and 1862 also suggest an awareness of the rapidly changing nature of water laws and regulations in this period and a concern to secure as much legal right to the water as possible (Davies and Lawrence 2014). The partners had the administrative capacity to work through the 'cumbersome and expensive process of applying for a [water] license' as required by the legislation and regulations (Royal Commission 1862–1863:17). The LLWA was by no means the first group of mining entrepreneurs to divert the waters of Lal Lal Creek, the West Moorabool River and nearby watercourses for mining purposes. Beginning in the 1850s a number of parties constructed races to deliver water westward to Ballarat, which involved substantial investment in labour and materials. The Moorabool Enterprise Sluicing Company, for example, was granted a permit in 1857 to cut a 13 mile (21 km) race from the West Moorabool to the Nerrina diggings north of Ballarat. Other groups included the Devil’s Creek Company and the Lal Lal Mining Race Company, along with the Little Bendigo Sluicing and Mining Company which built a race 18½ miles (30 km) long (Ballarat Star 24 August 1858:2; 22 Dec. 1858:2; Nathan 2007:13–18; Patterson 1862: 173). Once constructed the races were guarded and maintained by race keepers in the forest. One of the most substantial enterprises for supplying mining water in the district was a 17- acre (6.9 ha) reservoir built on Felli-monger Creek by American miner John Kirk in 1857. Ownership of the dam was transferred to the Department of Mines in 1861 before passing to the councils of Ballarat and Ballarat East in 1862 for £4000 (Ballarat Star 3 Feb. 1865:2; Bate 1978:86; Nathan 2005:59). Kirk’s Reservoir continues to supply water to Ballarat today.

The development of these water supply schemes for the miners at Ballarat provided the context for the establishment of the Lal Lal Waterworks Association. The members recognised that a supply of water in Lal Lal Creek could be harnessed effectively and delivered to miners on the Moorabool (Dolly’s Creek) goldfield about 20 km to the south. Part of the water was to be used to supply the Association’s own mining operations, but the majority was intended to supply miners paying a rent or tribute (Royal Commission 1885:198). Archibald Fisken owned or leased large tracts of land around the lower reaches of Lal Lal Creek and was thus able to facilitate construction of the main storage dam and the water supply races. Construction of the LLWA infrastructure also coincided with construction of the Geelong to Ballarat railway, completed in April 1862, which skirted the western edge of the Lal Lal scheme (Griffiths 1988:53). Archibald Fisken was one of the main proponents of the LLWA. He was born in Glasgow in 1829 and arrived at Port Phillip with his family in 1840. At age 17 he was given charge of the cattle stations of his uncle, Peter Inglis, at Lal Lal and Warrenheip to the east and south of Ballarat. With the discovery of gold in 1851 his workforce departed but he soon made a fortune supplying meat to the miners nearby and purchased the stations from his uncle. By the late 1850s he had acquired large areas of land along Lal Lal Creek and the West Moorabool River (Nathan 2007:81). When land was opened for selection in the 1860s Fisken lost much of his lease property except for 10,000 freehold acres he purchased at auction. He built a substantial homestead adjacent to Lal Lal Creek and a large ornamental lake immediately upstream (Figure 2). Over the years Fisken held many public offices in the Ballarat region including Shire Councillor and Justice of the Peace. In 1873 he moved to Melbourne where he could oversee his diverse business interests in Australia and Scotland. He died in 1907 at the age of 78 (The Argus 14 June 1907:6; Hone 1972:174).

Figure 2: The lake at Lal Lal c. 1866 (A.V. Smith, State Library Victoria PCLTAP, 299)
One of the major features of the LLWA system was a large dam constructed on Lal Lal Creek downstream from Fiskens’ homestead. This provided the storage capacity to deliver water through the extensive race network. Lal Lal (or Fiskens’) dam was the main storage reservoir in the LLWA supply system, built about 3 km above Lal Lal Falls and 4 km from the junction with the West Moorabool River. It was a simple earthen gravity dam, built long and low across the wide valley. Construction of the dam was completed in November 1862 and its waters covered parts of both Fiskens’ land and Crown land frontage along Lal Lal Creek (Ballarat Star 23 June 1865:2; Nathan 2005:63). The height of Fiskens’ dam wall was around 15 feet (4.6 m) and the reservoir was approximately 1¼ miles (2 km) long. It covered an area of about 116 acres (47 ha) and held up to 90 million gallons of water (409 ML; Griffiths 1988:65; Royal Commission 1885:199). The site of the dam today is open grazing country.

The LLWA system

Lal Lal dam was one of the largest privately constructed reservoirs for mining purposes built in Victoria. Its location above the 34 m drop of Lal Lal Falls nearby meant it had enough height (or head) to deliver water through the system to the Moorabool diggings. The dam itself consisted of an earth and clay wall across the gully which held back a large volume of water. The shape of the land, however, meant the dam could not be built much higher as water would have flowed over both sides and potentially flooded the Lal Lal–Egerton Road at the upper end of the reservoir (Royal Commission 1885:204, Q5350). Robert Brough Smyth’s list of government reservoirs on the goldfields in 1868 indicates that the Lal Lal dam only came to be substantially exceeded in capacity during the 1870s with construction of storages associated with the Coliban System of Waterworks (Smyth 1980:550; Russell 2009:96). While there were hundreds of small dams built by miners on the goldfields few if any approached the Lal Lal dam in terms of storage capacity (Sankey 1871:62–68). The size of the dam meant it also served as an important local recreational resource, used for boating and sailing (Nathan 2007:77).

Other features of the LLWA system included five smaller dams, 60 miles (96 km) of water races, a tunnel 15 chains (302 m) long, 42 chains (845 m) of open cuttings approaching the tunnel, two culverts under the Geelong and Ballarat railway and 77 chains of timber fluming to carry water over several gullies and the Moorabool River (MSR June 1864:20; Royal Commission 1885:198). Digging the tunnel through a low spur near the township of Lal Lal meant that excavation of a long section of race around a contour to the west could be avoided.

The dams and races were not complicated to build, although the tunnel and culverts required engineering expertise. Chinese gangs were often employed in the district to cut races and other water features (Davies et al. 2011:29). The races were opened on 21 January 1863, a few months after completion of the main dam (Ballarat Star 23 June 1865:2). The group claimed to have spent the very substantial sum of £8800 in constructing their scheme (Royal Commission 1885:198). During this early period, however, there was frequent ‘growling’ from many miners who could not gain access to sufficient water from the LLWA to work their claims (e.g. Geelong Advertiser 8 August 1863:3).

The main supply outlet emerged from Fiskens’ dam as a timber flume 144 feet (44 m) in length, consisting of joined timber boxes each 12 feet long, 18 inches wide and 18 inches deep (General Correspondence Files 1889–1890). The flume delivered water across Lal Lal Creek into the main supply race which was up to five feet (1.5 m) wide and two feet (0.60 m) deep. The race ran within a reserve or easement 25 feet wide, which included the width of the race itself and 10 feet to each side. It extended from Lal Lal Creek a short distance below the main dam and passed through a culvert beneath the Geelong–Ballarat railway line (Figure 3). It then skirted the headwaters of Williamson Creek and passed through a second culvert beneath the railway west of Mount Doran. The race then turned eastward for about two miles, with the supply boosted by water held in three dams on creeks flowing south from Mount Doran (General Correspondence Files 1860–1889).

The race then passed into a distributing dam, known as Connell’s, with a capacity of around 8 million gallons (36 ML), located near the Mount Doran state school (No.1434). From this point races branched in several directions to convey water throughout the Dolly’s Creek diggings. One race extended south around the racecourse reserve and then east towards the West Moorabool River. A branch from this race passed around the reserve of Dolly’s Creek state school (No.194) and terminated in deeply sluiced gullies. Another race looped eastward and crossed the upper part of Dolly’s Creek on a long section of fluming 22 chains (443 m) in length and up to 17 feet (5.2 m) in height, before passing south towards Charcoal Hill (Borhoneyghurk 2001; Dicker 1863:220). In June 1864 it was reported that water had also been carried to a location known as Evan’s Rush on fluming from the Tableland area across the Moorabool River (MSR June 1864:20).

The complex network of branching races ensured that substantial areas of the goldfield were within reach of a water supply. In 1863 miners paid £3 per week for one sluice-head, which in the Ballarat Mining District referred to the volume of water passing through an opening in a sluice-box 16 inches wide and one inch high with a six-inch ‘head’ behind, officially providing about 211,500 gallons (960,000 litres) per day (Smyth 1980:405). The LLWA could initially supply 10 sluice-heads to miners, thus earning about £30 per week, but it was expected the amount of water delivered, and the profits to the LLWA, would increase substantially as miners completed their own races and sluice areas (Dicker 1863:220). Despite these optimistic projections, however, water supply to miners was often deficient in the early years of the LLWA’s scheme and many departed to the goldfields in New Zealand and elsewhere in search of better prospects (Geelong Advertiser 5 Sept 1862:2; 8 August 1863:3).
Beales Reservoir and the Ballarat Water Commission

Just as the Association began operating it faced a major challenge to its water right. Demand for a secure domestic water supply in Ballarat had increased significantly during the dry years of the late 1850s. The Ballarat Water Committee (later Commission, BWC) observed the creeks flowing out of the Bullarook Forest and identified a lagoon known as Harry Beale’s Swamp, the headwater of Lal Lal Creek, for its potential to serve as a major supply reservoir. The BWC built a dam at the southern end of Beales Swamp during 1863 and the reservoir filled during 1864, capturing much of the supply from Lal Lal Creek. The reservoir had a capacity of 52 million gallons (236 ML; Royal Commission 1885:199) and the new water was transferred by a channel to Kirk’s Dam near Ballarat. This seizure of water for an expanding urban population resulted in a great deal of hardship to residents in the Bullarook Forest, as well as to companies with pre-existing water entitlements and to communities living downstream along Lal Lal Creek. It also led to prolonged legal conflict with the Lal Lal Waterworks Association (Nathan 2005, 2007).

The LLWA objected that Beales Reservoir interfered with its priority of right to the summer flow of water in Lal Lal Creek (Nathan 2005:60). The legal contest began in 1864, when the LLWA brought a suit against the Ballarat Water Commission in the Warden’s Court at Meredith for loss of earnings of £1000. The court found in favour of the LLWA and awarded £850 damages (Ballarat Star 1 Dec. 1864:2). A second hearing in the following month at the Steiglitz Warden’s Court produced similar findings but the damages were reduced to £100, with the Association arguing successfully that their water right license pre-dated BWC works and that the Commission was not legally constituted to provide Ballarat with water (Ballarat Star 10 Jan. 1865:4; 3 Feb. 1865:2; Nathan 2005:65).

The BWC appealed the decision in the Steiglitz Court of Mines in June 1865, and the case was referred to the Supreme Court later in the year (Ballarat Star 23 June 1865:2–3). Chief Justice Sir Redmond Barry ruled that the local warden did not have jurisdiction in the case (Ballarat Star 11 Sept. 1865:2 [supp.]) and the Ballarat Court of Mines thereafter ruled that each side should pay its own costs (Ballarat Star 18 Sept. 1865:4). The LLWA finally received compensation in 1871 for loss of water and revenue, several years after the legal rights of the water company had been established in courts and recognised by arbitration (Nathan 2005:67).

Prior to the loss of water to Ballarat the LLWA supplied water to as many as 700 miners. The Association had expected to be earning up to £90 per week in water sales by this stage, but the reduction of supply by the BWC diminished returns to £30 to £40 per week. John Fairbairn, the Secretary of the LLWA, indicated in 1865 that the business had no written £30 to £40 per week. John Fairbairn, the Secretary of the LLWA, indicated in 1865 that the business had no written

There were calls in 1866 to compensate the LLWA for water lost to the BWC. Henry O. Christopherson, the engineer-in-chief of the Victorian Water Supply Department, took the view that the LLWA had ‘sustained material injury’ and that the BWC should be called upon to share the expense of increasing the storage capacity of the LLWA’s reservoirs. One possibility was to heighten the dam walls and enlarge their capacity. Alternatively, a nearby watershed could be ‘granted’ to the Association. This proposal involved construction of a 4½ mile (7 km) aqueduct to divert water from the West Moorabool River to the Association’s main dam on Lal Lal Creek at a cost of about £500 (General Correspondence Files 1860–1889). Christopherson believed that some of this water could also be used to supply the township of Steiglitz via a 25 mile (40 km) channel to the south, but the proposal appears to have lapsed (Royal Commission 1885:199).

Ballarat was not the only metropolitan centre eyeing off the water of Lal Lal Creek during this period. Geelong was also growing rapidly during the 19th century but townswomen were initially forced to rely on the muddy waters of the Barwon River for domestic supply. As early as 1859 a report to the government identified the Lal Lal area as a potential future source of water (Johnson and Foord 1859–1860:2). Lal Lal Creek was also reviewed among several possibilities in 1863 to increase the Geelong supply, but the Stony Creek reservoir was eventually constructed instead (Edmonds 2005:41–48).

In 1885 the Royal Commission on Water Supply heard the earlier proposal to cut a channel from the West Moorabool River to Fisken’s dam on Lal Lal Creek with a view to providing up to 3 million gallons of water per day for Geelong (Geelong Advertiser 10 March 1885:3). Miners at Dolly’s Creek, however, were worried that ‘the Geelong people are going to take the water away from us’ (Royal Commission 1885:205, Q5390). Although nothing came from the proposal, survey work in 1887 again identified Lal Lal Creek as a likely water source to augment Geelong’s supply (Edmonds 2005:53). It was not until 1972, however, that the waters of Lal Lal Creek were captured in Bungal Dam and used to supply both Geelong and Ballarat (Edmonds 2005:230–231). Several hundred Chinese miners were engaged in intensive ground sluicing at Dolly’s Creek by the mid-1860s, using water supplied by the LLWA. The fields at Morisons and Tea Tree, however, were dominated by European miners (Lawrence 2000:46; MSR Dec. 1864:16). A local correspondent for the Geelong Advertiser blamed the Chinese for polluting the waters of the Moorabool with mining sludge which may have extended as far downstream as the Barwon River at Geelong (Geelong Advertiser 15 Nov. 1864:3). Chinese miners may also have wanted water for garden plots, which became commonplace on the goldfields from the 1860s, creating produce both for their own community and for Europeans (Frost 2002).

Early in January 1872 Archibald Fisken ordered the sluice on the Lal Lal dam to be opened and drained off almost half the water held in storage. He was reported to have been concerned that a large body of water lying so near his homestead was having a harmful effect on the health of his family (Geelong Advertiser 24 January 1872:3). The water had been there for a decade, however, without any reported problems. A more likely reason for draining so much away was a dispute with his partners in the LLWA and a decline in profits. Although the group’s 15-year water rights licence was not due to expire until 1878, it appears that Fisken was unwilling to extend the (possibly private) arrangement by
which the dam waters covered some of his own land. Water continued to flow through the race network in the final weeks of 1871 but the security of the system was uncertain and employment for several hundred men was threatened by ‘the selfish act’ of Mr Fisken (Geelong Advertiser 17 January 1872:2).

The dispute also highlighted tensions between European and Chinese miners at Dolly’s Creek. The former tended to stockpile their dirt and wash it about once a month whereas the Chinese were allegedly using water to sluice every week (Figure 4; Lawrence 2000:45). Only a limited supply of water remained in the distributing dam near Mount Doran by the middle of summer. A party of Chinese miners, however, offered to lease the water works for £450 per annum to ensure a supply for the Dolly’s Creek and Morrisons goldfields (Geelong Advertiser 24 January 1872:3). It is not clear if the Chinese offer was accepted but the Victorian government appears to have taken control of the LLWA race system in 1874 following a decline in reliable water deliveries and agitation from residents at Morrisons, Dolly’s Creek, Table-land and Elaine (Geelong Advertiser 18 June 1874:2). The government cleaned out the channel and replaced an old section of fluming. In 1879 the easement through which the race passed was widened from 25 feet (7.6 m) to one chain (20 m) in width and the land was formally excluded from occupation for mining, residence or business purposes (Government Gazette 14 February 1879:352).

The LLWA race system passed back into private hands in 1881 when David Morrison took out the lease at a rent of £25 per year (Parliament of Victoria 1880–1881:427; MSR June 1881:26; Royal Commission 1885:203, Q5335). After a few years, however, Morrison left the district and sub-let the race to Samuel Bulwer, a local herdsman, but there were complaints during this period about the poor upkeep of the race system, how it was ‘growing up with grass and rushes and sand silt’ and delivering only a fraction of the water available and needed (Royal Commission 1885:203, Q5324). Miners at Morrisons and Dolly’s Creek were reported at the time as ‘barely making a living’ (MSR Sept 1881:28). Expiration of the lease in December 1884 saw Moorabool post-master George Silvester take temporary charge of the works (Geelong Advertiser 18 December 1884:4). The Royal Commission on Water Supply heard in 1885 that there were only about 20 miners left at Morrisons, who were ‘mostly old men ... left there in their old age to make the best of it’ (Royal Commission 1885:205, Q5398). When the Lal Lal dam was destroyed in the late 1880s the water system became effectively obsolete, and by the turn of the century only a few fossickers remained to pick over the once-thriving goldfield (Bradford 1903:6; Nathan 2007:77).

The story of the LLWA, however, was not quite finished. In February 1889 a group of local people petitioned the government to establish a Waterworks Trust over an area of about 11,500 acres at Morrisons under the Irrigation Act 1886. The legislation on water trusts provided government loans to local bodies which would control the distribution of water within their territories (Powell 1989:112–117). The group was led by William Muter, a long-term miner, resident, publican and shire councillor from Morrisons. Other petitioners included 40 men from Borhoneyghurk, Dolly’s Creek, Buninyong Shire and Ballan Shire. They planned to rejuvenate the decayed dam and race network of the LLWA by repairing some its features, building a new dam in Long Gully and buying out existing water rights, all for a total of £2000. The aim was to deliver 500,000 gallons (2.3 ML) of water per day for irrigation, stock and domestic supply, and mining purposes (General Correspondence Files 1889–1890).

The government commissioned a report on the proposal by Chief Engineer N.A. Graydon in April 1889. Graydon was scathing in his assessment, pointing out that there was actually
very little arable land in the area, only a small number of ratepayers to cover the costs and little likelihood of the proposed works being able to deliver the desired volume of water. Areas of auriferous land that had been inaccessible to the old race network would still be unworkable as no detailed surveys and levelling had been carried out. Graydon argued that the Lal Lal race had fallen into disrepair with the exhaustion of surface deposits and the exodus of diggers, and that restoring the water supply would not lead to a revival of mining. It was clear that the petition was really about restoring alluvial sluicing works under the guise of irrigation development. With no support from public officials the proposal lapsed.

Interpreting the physical evidence

Examination of the surviving physical remains of the network suggests several factors that contributed to the eventual failure of the scheme. The first of these is length. With over 96 km of race, the LLWA network was one of the longest in Victoria. One of the few that was longer was that of the Pioneer Water Company, which in 1859 began cutting a 70 mile (113 km) race from the Kiewa River to Yackandandah on the Ovens goldfield. It took three years to complete and although ample water entered the race at the source, loss from leakage meant it was an insignificant stream when it reached its destination (Lloyd 2006). A more successful enterprise was conducted by Farnsworth and Stewart on the Amherst and Talbot goldfield near Maryborough in central Victoria. The company completed a large dam on Stony Creek in 1864 and by 1871 the system included 400 km of head, supply and distribution races (MSR June 1871:33). Sluicing parties each paid £2 per week for two sluice heads or almost 17 million litres of water. The system also provided water for gardeners, brewers and for a successful hydraulic sluicing operation at Kangaroo Flat. In 1875 the Borough of Amherst purchased the Talbot Reservoir, which remains part of the town’s domestic supply today (Bannear 1998).

A common misconception was that a very long channel had no bearing on the endpoint of delivery. There were a range of factors, however, affecting flows in the LLWA system and others like it. These included the head of water, which was the difference in vertical height between the source of supply at Fiskens’s dam and the point of delivery far away on the Moorabool goldfields; and the profile of the races themselves, which were typical in size and cross-section for mining water races throughout Victoria (Figure 5). Rough sides of the channel and an irregular profile increased friction and turbulence, while sediment load, debris, seepage and evaporation all affected water flows as well. These put limits on water volumes which in turn effectively capped the amount of money the LLWA partners could earn from the entire scheme. The ideal mining water network was short, deep and direct – the LLWA system, however, was long, complex, meandering and shallow.

A second factor in the failure of the system was water loss through seepage and evaporation, a problem to which the length of the network contributed. In 1870 British engineer Richard Sankey arrived from India to report on the Coliban System of Waterworks, then under construction to supply Bendigo and Castlemaine. As part of his investigation he also examined the hydrological performance of the River Loddon Company’s 17-km-long race at Fryerstown in central Victoria. The race was about 3 feet (0.9 m) wide and 2 feet (0.6 m) deep and cut through schist rock. Measurements indicated water loss of about 18.5% over the total length of the channel by soaking and evaporation (Sankey 1871:103). The LLWA network, with almost 100 km of races, was subject to even greater loss of water. Much of the water stored and released at the head of the supply race never made it down to the miners on the Moorabool goldfield. Using Sankey’s figures as a guide, perhaps one-fifth or more of the LLWA’s water was lost between source and destination. Measurement of flow and discharge in open channels is often calculated using Manning coefficients, in relation to roughness of the channel wall and thus friction and turbulence. Their use is usually for relatively smooth masonry and concrete conduits rather than the very rough and highly variable races on the goldfields and so the method does not work well here.

In addition to losses from the race network the LLWA was also losing water from its major supply dam. Fiskens’s dam was only 5 m deep at most and covered land that was relatively flat. With a large surface area of 116 acres (47 ha) and shallow depth, the reservoir was subject to a high degree of evaporation, especially in the summer months. In addition, much of the water flowing down Lal Lal Creek had been cut off and diverted in 1864 by the BWC and not restored. When Fiskens drained off half the water in the dam in 1872 this further limited the volumes that could be diverted to miners downstream.

Inspection of the races suggests a third contributing factor in the scheme’s failure which is poor efficiency of flow. Where access to the race has been possible embankments have been observed alongside the race (Figures 6 and 7). These embankments were produced when debris was removed for maintenance. The mound of silt occupies two to three times the volume of the water channel, indicating that the LLWA network carried substantial amounts of silt that necessitated considerable cleaning. Silt, grasses and rushes in the bed of the race also reduced the volume of water and slowed the flow, which in turn restricted the volumes available to miners and limited financial returns to the association.

Maintenance of the dams and extensive race network was thus an issue as well. Several race keepers had to be employed to keep the channels clear of silt and debris, repair holes and breaches, and check water levels in dams and flumes (Walker 1861–1863). At wages of around £100 per annum, the weekly cost of employing three race keepers, including manager George Hunt, may have cost the LLWA around 20% of gross profit. Having spent close to £9000 to build the system it would have taken more than six years just to recover the initial investment before a dividend was returned.

Figure 5: Remnant water race of LLWA in farmland. (P. Davies)
The partners in the LLWA saw value in supplying water to the miners at Dolly’s Creek but they were unable to recognise the relative poverty of the goldfield. Archibald Fisken, for example, had made his fortune in sales of land and livestock but shareholding registers indicate he only dabbled in goldmining. He was not closely involved in the industry and by 1872 he preferred to reclaim his land under the waters of the Lal Lal dam rather than risk his family’s health or lose feed for cattle. Likewise, the LLWA secretary, John H. Fairbairn possessed just one share in one mining company and otherwise demonstrated little direct involvement in the industry (McAdie 2006). It is likely that most of the technical expertise was provided by George Hunt, William Standring and William Rowbottom, the trio of surveyors and engineers who had already investigated the upper catchment to identify sources of water that could be sold. Fisken owned the land they wanted to use to build the storage, had capital, and had access to influence so it made sense to join forces. However, if their expertise was in water supply, they too would have been ill-equipped to accurately judge the quality of the newly discovered goldfield above Morrisons.

The LLWA also suffered several setbacks in the early years of operation. In January 1863, engineer William Standring was killed fighting a fire at Mount Doran (Ballarat Star 10 Jan. 1863:2; Dicker 1863:220), while secretary George Fairbairn died in November 1865 at the age of 39. Both men had played key roles in establishing the LLWA and their loss deprived the Association of much of its energy and management skill. In addition, the Ballarat Water Commission was unrepentant in claiming and retaining the headwaters of Lal Lal Creek for Ballarat in 1863–1864, depriving the LLWA of much of the water it expected to provide to miners.

Conclusion

The LLWA was a private water company that invested a large amount of money to appropriate a water supply, defended their rights to the water when threatened by Ballarat interests, and profited by selling water to hundreds of miners. The group thus differed in scale and focus from most small groups of gold miners in this period who pooled their resources to build dams and races to secure a water supply. The Association had access to substantial capital, political influence and legal resources and took advantage of these opportunities to emerge rapidly as major water merchants in colonial Victoria.

Archibald Fisken was an important and influential partner in the LLWA but he signalled his waning interest in the Association in 1872 when he drained off about half the water in the supply dam, leading to complaints about lack of supply. The partners gave up their lease on the network and it passed to the Victorian government in 1874, before the final collapse of the system in the late 1880s. Unlike many contemporary mining water systems, the LLWA network was never incorporated into a municipal supply network, a clear sign that it was unable to deliver reliably large volumes of water.

The LLWA is an example of failed ambition, the sheer scale of the enterprise working against its ultimate success. While good storage capacity was available in the main supply dam on Lal Lal Creek, there was substantial water loss along the long route of the supply and distributing race network. Upkeep of races and flumes was also a continual cost, while the nature of the Moorabool goldfield, a ‘poor man’s diggings’, meant there was never enough gold to justify the heavy investment of building a major mining water system. While the group tried to achieve too much with too little, its efforts nevertheless represent an early and influential response to capturing and commodifying water supply on the goldfields.

References

THE ARGUS 14 June 1907, p. 6.

BALLARAT STAR August 1858, p. 2; 22 December 1858, p. 2; 10 January 1863, p. 2; 1 December 1864, p. 2; 10 January 1865, p. 4; 3 February 1865, p. 2; 23 June 1865, p. 2–3; 11 September 1865, p. 2 [supp.]; 18 September 1865, p. 4.

BANNEAR, D. 1998, Historic Gold Mining Sites in Amherst Mining Division, Maryborough Mining Division, Victorian Goldfields Project, Department of Natural Resources and Environment, Melbourne.


BORHONEYGRUK 2001, Borhoneygruk Unpublished Geological Parish Plan, Department of Natural Resources and Environment, Melbourne.


Schemes of Water Supply, No.48, Parliament of Victoria, Melbourne.

