The River Loddon & Tributaries Water Supply Company

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Water was vital to the success of gold mining in nineteenth-century Victoria. Miners needed large volumes of water to separate gold from the washdirt and they often went to great lengths to divert water from where it was available to where it was needed. Water supply companies were formed in response to the needs of miners for water and often to service domestic consumers as well. In this paper we review the history of one company supplying water on the Mt Alexander (later Castlemaine) goldfield of central Victoria, which was the richest surface alluvial goldfield in the world when first rushed in 1851-1852.[1] When other Victorian alluvial goldfields such as Beechworth and Creswick moved into ground and hydraulic sluicing later in the 1850s Mt Alexander lagged behind, restricted by the lack of access to large quantities of water. By the late 1860s dozens of water licenses had been taken up on other goldfields, but at Castlemaine there was only one holder of a licensed water right.[2] The problem was not fully solved until the completion of the government's Coliban System of Waterworks in 1877, at which point sluicing around Castlemaine began to enjoy the same boom that had previously swept the other fields. Closer study of the Mt Alexander field's single water licence holder, the River Loddon & Tributaries Water Supply Company and its successors (hereafter referred to collectively as the Loddon Company), illustrates the challenges of supplying water in the Mt Alexander region, the costs and complexities of managing water on the goldfields over an extended period, and the often fraught relations between private suppliers and public water authorities.

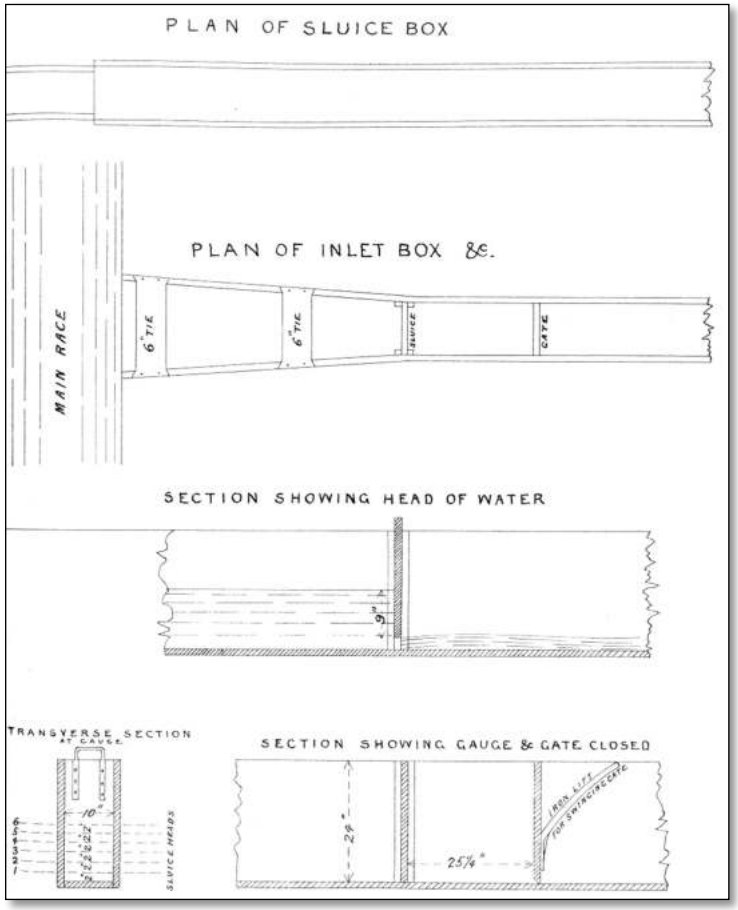
The activities of the Loddon Company centred on Fryer's Creek, an area about 10 km south-east of Castlemaine and later known as Fryerstown. The steep hills and ridges of the area meant that capturing and diverting water to mining claims was difficult and expensive. The race system developed by the company from the late 1860s soon came to dominate the supply of water for sluicing in the area and was unique in several respects. Its singular domination of the field was in contrast to other mining districts in Victoria, where numerous parties established their own supply networks.[3] Despite its virtual monopoly, however, the Loddon Company was a comparatively small, poorly capitalised operation controlled by a succession of small local miners. This was in contrast to the large-scale operators on goldfields such as Beechworth, Clunes and Heathcote.[4] The Loddon Company was also distinctive as for many decades it had to operate alongside the Coliban System of Waterworks, the much larger scheme created by the Victorian government and built with public money.[5] In various guises the Loddon Company was able to survive for nearly 100 years, making it possibly the longest operating mining race anywhere in Victoria. Much of the physical evidence of the Loddon Company's infrastructure survives today in the bush south of Castlemaine,

providing an opportunity to understand in detail the role of water on the goldfields and how mining came to a standstill without it.

Water and capital

Abundant water was vital in all branches of mining and quickly became a valuable commodity on the goldfields. Those who controlled it soon became water merchants, monopolising supplies to other parties. Miners with capital who saw the value of controlling water invested large sums in dams and races, selling water to those willing and able to pay for it. By the mid-1850s miners had begun to buy, lease and sell their networks of races and dams to other mining parties, a process that gradually received legal recognition in the following years.[6] Networks of races came to be etched onto the landscape of the goldfields to distribute water for mining and by the late 1860s almost 4,000 km of races had been created in Victoria.[7]

Figure 1: *Plans and sections of sluice-boxes.*



Source: R. Sankey, *Report on the Coliban and Geelong Schemes of Water Supply*, Parliament of Victoria, Melbourne, 1871, Plate 10.

The legal right to excavate dams and races for mining purposes was formally granted to holders of Miner's Rights in 1857. An Amending Act in 1862 regularised mining water diversions with the issue of Water Right Licences for up to 15 years, with rent of at least £5 per annum and a yearly charge of 10 shillings for every million gallons of water drawn from a reservoir.[8] Around half of these licences were held by

alluvial-miners in north-eastern Victoria, with the only example taken out in the Castlemaine area (No. 304) held by the River Loddon & Tributaries Water Supply Company.[9] Specific volumes of water were also regulated for sale. These were measured by 'sluice-heads', the amount of water that flowed through a wooden trough, known as a sluice box, with a narrow opening at one end. Volumes per sluice-head varied throughout Victoria, with miners in the Castlemaine district using an official measure of 202,000 gallons (0.92 ML) over a 24-hour period, the lowest amount of water delivered per sluice-head in the colony's seven mining districts.[10] These measures persisted until around the turn of the century, after which a sluice-head was standardised at one cubic foot per second.[11]

Water companies had different emphases and priorities. Some were more or less alluvial sluicing operations that focused on gold mining and sold excess water to other parties when it was available. Examples of these were especially common on the Ovens, Buckland and Upper Goulburn goldfields and to a lesser extent at Ballarat and Creswick.[12] Other companies aimed to capture water and distribute it to local miners on a wider scale, making money principally by the sale of water. The Lal Lal Waterworks Association, for example, built a large reservoir and almost 100 km of races in 1861 to supply miners on the Moorabool goldfield between Ballarat and Geelong.[13] Still others were larger concerns intent on supplying water to both miners and town dwellers, and these often sought the financial support of shareholders and the legislative backing of governments. A well-known example was the Bendigo Water Works Company, formed in 1858 to supply domestic and mining water to the Bendigo Valley, which was later incorporated into the Coliban System of Waterworks.[14] In north-east Victoria, the Ovens Gold-Fields Water Company, founded in 1859 with £50,000 in capital, was an expensive failure.[15] Distinctions between these different kinds of water companies, however, were not always clear and they could change their focus depending on seasonal conditions, gold discoveries and the competition offered by other water providers.

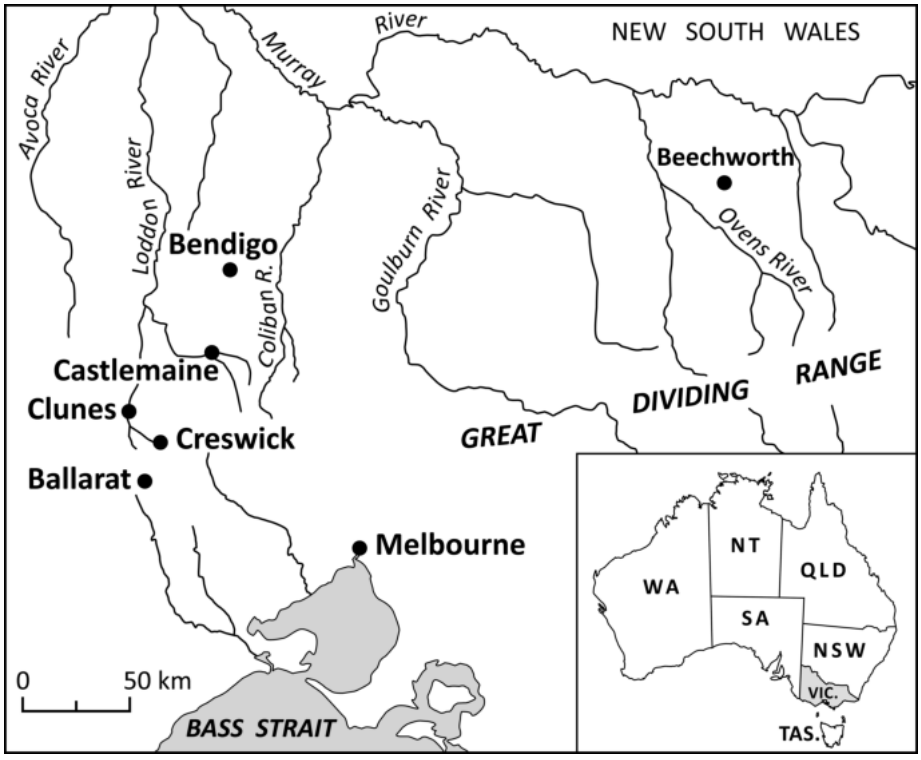
Landscape History

Castlemaine is located about 120 km north-west of Melbourne on the northern slopes of the Great Dividing Range. Mount Alexander forms the most dramatic landscape feature of the district, rising to a height of 741 m from a long narrow range. The greater part of the Castlemaine goldfield is characterised by gentle to moderately hilly terrain comprised of sandstones, mudstones and slates. Numerous gold-bearing quartz veins intersect the Palaeozoic basement rocks, forming a series of parallel, north-south trending saddle reefs. Over time, erosion filled small waterways in the area with alluvium, with much of the rich gold-bearing ground presenting as surface or shallow alluvial deposits. The region was subject to intensive alluvial mining during the 1850s and quartz-reef mining in the following years.[16] Alluvial mining often languished due to lack of water needed to separate gold from the washdirt. Bucket dredging also occurred around the turn of the century[17] but most gold mining in the area had ceased by the First

World War, with total gold production from the Castlemaine district amounting to approximately 5.4 million troy ounces, or 173 tonnes.[18]

The headwaters of the north-flowing Loddon River and its tributaries were a major focus of both alluvial and quartz-reef mining from the 1850s onward. The climate of the region is temperate, featuring cool winters and warm to hot summers, with a long-term average annual rainfall at Fryerstown of 23.5 inches (597 mm).[19] The elevation of the Fryerstown area generally ranges between 300-400 metres above sea level. Dry years had a major impact on the miners, with many goldfields coming to a standstill in the summer through lack of water. Bendigo, for example, was well known in the nineteenth century as a 'winter diggings'.[20] The Loddon River, a small waterway by any standard, often ceases to flow in summer months and episodes of drought are historically common. Fryer's Creek is a small tributary that rises in the ranges dividing the Loddon and Coliban watersheds and joins the Loddon near Vaughan. Gold deposits along its length made it an important centre on the Mt Alexander goldfield throughout the latter half of the nineteenth century.

Figure 2: *Regional map of central Victoria*.



Source: Archaeology, La Trobe University.

Fryer's Creek Sluicing Company

The culture of the small miner was strong at Castlemaine. There were few powerful mining magnates such as those at Ballarat or Bendigo, no stock exchange to invite financial investment and speculation, and few who identified themselves as 'gentlemen'.[21] Small miners resented and resisted private companies that sought to take out large claims for sluicing 'worked out' ground. By 1859, however, companies wanting larger leases met less resistance and goldfields capitalists around Victoria

began investing in large sluicing operations and building water supply infrastructure. While other districts were being flooded with capital for mining, Castlemaine languished in the realm of the small miner until well into the 1860s. Mining surveyor Thomas Brown noted that 'although there are hundreds of acres of auriferous hills in this locality that will pay for being sluiced, no attempt has been made to bring water to bear on [this] ground'.[22]

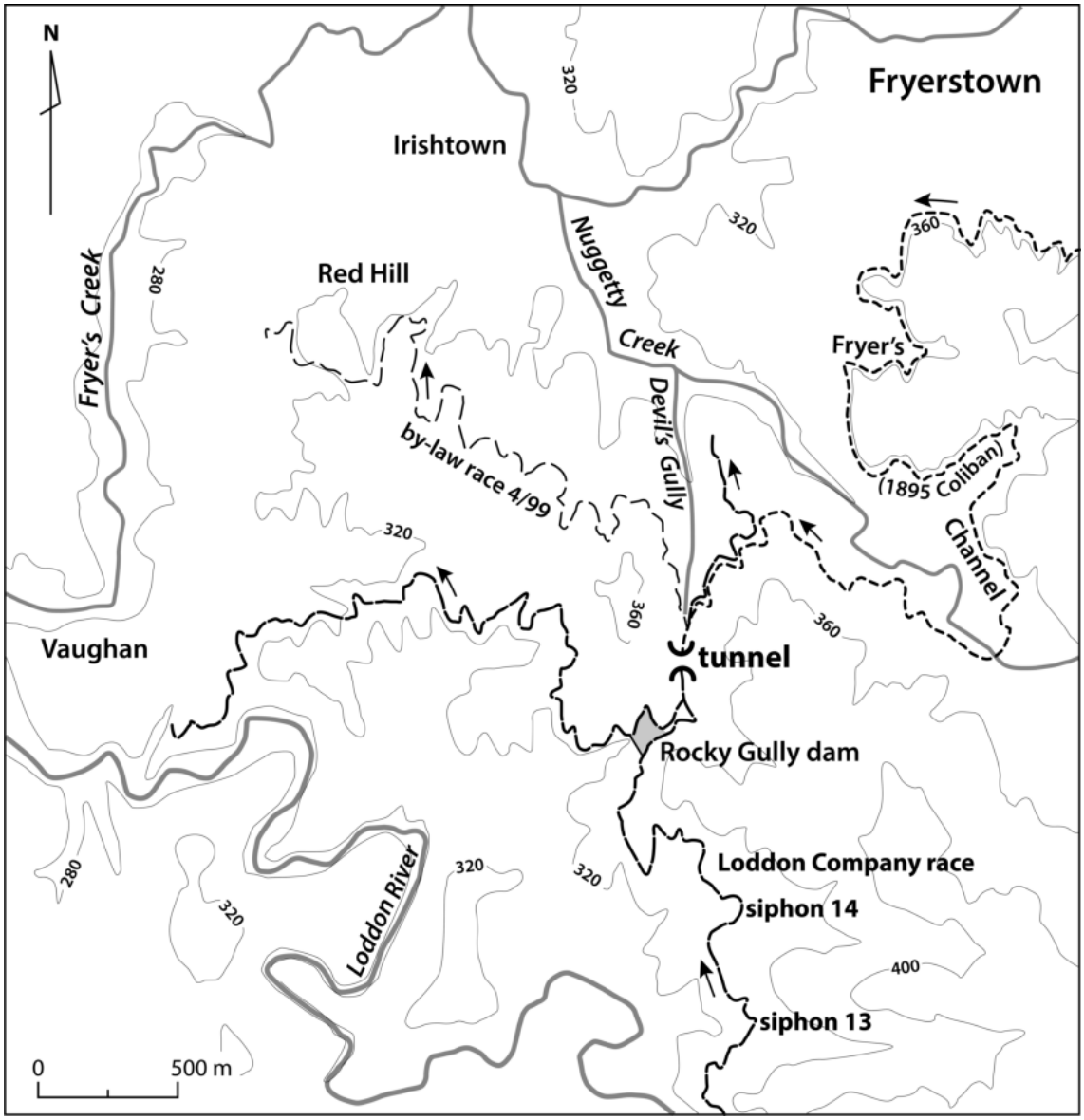
The period 1865-66 saw the worst drought recorded in Victoria to that time.[23] Two experienced miners, Mark Amos and Edward Wardle, formed the Fryer's Creek Sluicing Company, with 40 subscribers to the first share issue in 1866.[24] They aimed to divert water directly from the Loddon River near Glenlyon along a contour race to the heads of various gullies at Fryer's Creek. Natural river flows would normally provide about eight or nine months of water supply. They built a 15-mile (24 km) open channel that included 11 timber flumes on trestles up to 100 feet (30 m) high.[25] At the Fryerstown end the company built a tunnel, known as Devil's Gully Tunnel that was over 400 feet (122 m) in length. All the work was done manually with pick, shovel, hammer and drill. With separate gangs working on the race, flumes and tunnel, the project took only six months to build and was completed in 1866 at a cost of £5,000.[26]

Figure 3: *Southern entry to Devil's Gully Tunnel, Fryerstown.*

Source: Photograph by Peter Davies

Devil's Gully Tunnel was to be the crux of the entire water supply system for the next century, and the focus of much debate, uncertainty and dispute over water access and control. The company had originally planned for the race to cross the saddle atop Devil's Gully but in cutting the channel 12 metres in height was lost and the tunnel became necessary. The tunnel permitted the diversion of water into races flowing north-west and south-west to supply alluvial miners nearby at Vaughan and Irishtown. Archaeological survey and LiDAR data reveal that the race was excavated with a fall of eight feet per mile (1.52 m per kilometre), which meant the water would have flowed at roughly walking pace.[27] From the offtake on the Loddon River to the tunnel at Devil's Gully there was a notional hydraulic head of about 31 m. The final section of race approaching the tunnel from the south, however, was virtually level, which meant that water could effectively be pushed through the tunnel in either direction. Amos and Wardle anticipated that they would be able to use and sell their water in conjunction with the government-owned Coliban System of Waterworks to work a large area of ground. This link between private and public water networks, however, took another 40 years to complete.

Figure 4: *Water races converging on Devil's Gully Tunnel.*



Source: Diagram constructed by Co-author, Peter Davies.

Coliban System of Waterworks

The Coliban System of Waterworks was an ambitious and contentious scheme to provide reliable water supplies to Bendigo, Castlemaine and nearby townships. First mooted in the 1850s, the Victorian government invited formal plans and proposals in 1862, based on conveying water from the Coliban River northward to the goldfields. The winning plan of engineer Joseph Brady involved construction of a large dam at Malmsbury and running the water by gravity along 102 km of open channel to Bendigo, with a diversion along the way to Castlemaine. The plan also required a series of tunnels, siphons, flumes, baffles and other features. At the time, the Coliban System was one of colonial Australia's most ambitious water projects. Work progressed slowly over the following years, being hampered by lack of money, design problems and political squabbles. Water finally reached Castlemaine in 1874 and Bendigo in 1877, after more than 15 years of construction, 18 changes of government ministries and a

final cost of £850,000.[28] With upgrades, the Coliban System of Waterworks is still an important part of water supply in central Victoria today.

The system also included construction of numerous supply races around Castlemaine to provide large volumes of water for sluicing alluvial claims. These races, however, are poorly documented in historical sources and we have combined field survey with geospatial data to understand features of the network in more detail. The ten main branches had an aggregate length of 166 km, most of which were excavated through rock and remain well preserved today. A series of smaller reservoirs helped to maintain water levels and flows. By the 1880s, ample cheap water gradually rejuvenated gold mining in those areas serviced by the growing maze of channels. The reliability of supply is evident in the archaeological remains of the Garfield water wheel, built in 1887 to drive a crushing battery near Chewton. With a diameter of 70 feet (21.3 m), the Garfield was one of the largest water wheels built in the southern hemisphere. The wheel was linked via a flume to a branch channel from the Coliban system.[29]

In order for Coliban water to reach Fryerstown, a diversion from the Poverty Gully Channel had to be constructed and this required several expensive tunnels and deep cuttings. The local newspaper reported that the 1-mile-long (1.6 km) Cooper's Tunnel near Elphinstone was expected to be finished in mid-1876, but 'the race to convey the water to Fryer's Creek exists only on paper…[and] is not likely to be constructed for some time to come'.[30] Miners around Fryerstown eagerly awaited the arrival of the promised Coliban water but it was not to arrive to those south of the town until 1895.

River Loddon and Tributaries Water Supply Company

Operations by the Fryer's Creek Sluicing Company were short-lived and their race probably never had any water flowing in it. By 1869 the race had been taken over by the River Loddon and Tributaries Water Supply Company, with a large amount of capital subscribed by Melbourne shareholders.[31] The new company secured Water Right Licence No. 304 on 26 January 1870 under the *Mining Statute* 1865.[32] This 15-year licence allowed for the diversion of 7.5 million gallons (34 ML) from the Loddon River each day. The Mining Surveyor noted that the whole work had been 'carried out in a very satisfactory manner, the fluming being especially well constructed'.[33] Works were supervised by the company's civil engineer, George C. Darbyshire.[34] By 1871, a branch race westward to Vaughan was nearly complete and local demand for water among sluicers was high.[35] The company's rates to supply water were high, however, charging up to £1 per sluice-head (0.92 ML) per day, compared to £2-3 per week in the Ovens district where much more water was delivered per sluice-head.[36] Observers noted that miners paid the Loddon Company 0.8 of a penny per 1000 gallons but half that rate would be a fair price.[37]

Maintenance of water races was also a constant problem and added expense. Grass and weed growth within channels was often heavy, along with a build-up of silt and slumping from collapsed edges. Dead animals and fallen branches added to the debris that needed to be cleaned out regularly. Seepage and water loss was also

common. In 1871 Lieut-Col. Richard Sankey reported that 18½ per cent of the water in the Loddon race was lost to 'soakage', despite most of the channel being cut through rock.[38]

Miners at Fryerstown needed water from the Coliban system so they could have access to a cheaper supply. With gold yields declining, demand for water also fell during the 1870s, with most sluicing operations carried out by Chinese miners and only a handful of European parties. Three tunnels along the Fryer's Branch of the Coliban system were completed by 1877 and water flowed into Crocodile Reservoir, 2 km north-east of Fryerstown, the effective terminus of the system. At the junction of the Poverty Gully and Fryer's branches, the channel curves sharply through almost 170° and featured slabs of concrete lining the base and lower edges to minimise erosion, with intact sluice gates to control the flow of water into the Fryer's Branch.

Figure 5: *Junction of Poverty Gully Channel with Fryer's Channel.*

Source: Photograph by Co-author, Peter Davies

The Loddon Company, however, was not making a profit. The company skimped on the necessary maintenance of its system, so that by 1879 the race often ceased to run and fluming was in need of repair. The company declined to incur extra expense as dividends so far had been few and far between.[39] The company was still the only supplier of water to the elevated land south of Fryerstown. The 1887 Board of Inquiry that investigated the 'sludge question' on the goldfields reported that there were three parties engaged in sluicing with water from the Loddon Company race, with the resulting debris 'found many miles down the Loddon'.[40] At the same time, there were ongoing disputes in government over water control and whether it should continue to be under the management of the Mines Department or the Department of Water Supply, in recognition of the newly emerging irrigation industry.[41]

By the 1880s the old alluvial workings around Fryerstown were becoming exhausted and abandoned. The Loddon Company race had fallen into disrepair, still with no link to Coliban water supplies, and the company was wound up in 1883.[42] Several years later, however, the Chief Engineer for Water Supply, Stuart Murray, decided that an extension to the Fryer's race was justified, utilising a disused section of the Loddon Company race near Devil's Gully Tunnel to reduce costs to the government. Archaeological evidence reveals that the works involved blocking the north-flowing Loddon Company race and diverting the south-flowing Coliban water into a dam on Rocky Gully, with a short race connecting it to the west branch of the Loddon race. Thus on 17 August 1895, some 40 years after it was first promised, water from the Coliban system finally flowed all the way to Fryerstown and beyond to miners at Vaughan, connecting via the old Loddon Company network. Although the Federation Drought of 1895-1902 was about to hit hard, miners were soon purchasing 2.5 million gallons (11.4 ML) of water per week, paying around one penny per 3,000 gallons (13,600 litres).[43]

James Symes and jet elevator sluicing

Jet elevator sluicing was a new form of gold mining introduced to Victoria in the 1890s from New Zealand, where it was known as hydraulic elevating.[44] Among the pioneers of the technique in Victoria were James Symes and his brother, Mathew. They were keen to use jet elevator sluicing at Fryerstown, having served a long apprenticeship in hydraulic elevating in New Zealand. Physical evidence of the technique around Fryerstown includes numerous gullies dramatically eroded from heavy sluicing, along with extensive piles of tailings or mining waste and small 'poddy' dams connected to water races. Jet elevators employed the Venturi hydraulic principle, where water discharged under pressure through a pipe into a specially shaped opening (a *Venturi*) created a powerful suction effect. This lifted water and gold-bearing gravels up a large pipe onto elevated sluice boxes where the gold could be recovered.[45] The technique relied on the delivery of water to a point above the gully or area to be worked, where a pressure dam was constructed. At the bottom of the area there was an enclosed tailrace and a sump hole into which the suction pipe was fitted. The method was very economical once established as no fuel or machinery was required and only a few workers were needed to run the operation. It was adopted by a number of parties around Fryerstown soon after the turn of the century.

James and Mathew Symes saw that the old Loddon Company race, which had already had £12,500 spent on it, only needed cleaning and repair to be functional again, while the cost of an annual water licence was cheaper than paying for Coliban water. In 1902 James Symes applied successfully for a new water licence, No. 833, that entitled him to draw up to 15 million gallons (68 ML) of water per day from the Loddon River, at a time when the entire Coliban System of Waterworks could only supply 7 million gallons (31.8 ML) per day to Bendigo and Castlemaine combined.[46]

Crucially, Symes also held a small but strategic water race of 140 chains (2.8 km) under an old Miner's Right by-law. The race extended from the north end of

Devil's Gully Tunnel north-west to his other mining claims at Churches Flat. The Symes brothers joined with W.A. Twomey to form the New Zealand Elevator Company and spent the next 11 months cleaning and repairing the race network. They employed a caretaker and, at intervals, a gang of workmen at a total cost of around £200 per year.[47] They also installed a line of 20-inch pipes from the end of the race to provide water pressure to work two sets of jet elevators on a lease of 130 acres (52.65 ha). To guard against dry or drought conditions they undertook construction of a large reservoir at the head of the race capable of storing three months' supply of water, with about one acre sluiced per month.[48] The two sluicing areas employed 30-40 men and consumed about 7 million gallons (31.8 ML) per day.[49]

Symes resurrected the old north-flowing Loddon race by removing the blockage placed across it at Rocky Gully in the 1890s. He also intercepted south-flowing Coliban water in Devil's Gully Tunnel and relied on the latter when the Loddon River ceased to flow in the summer months. The tunnel thus acted as a large 'mixing bowl' and from it water could be distributed south-west and north-west along existing races built years ago by the Loddon Company.[50] This gave Symes control over both Loddon and Coliban water, which was to have a major impact on miners nearby who depended on the water supply to work their claims.

By the first decade of the 20th century a combination of jet elevators, hydraulic sluices and dredge plants were being used by miners around Fryerstown to work the alluvial gravels for gold. The scale and results of their work is evident in the massively eroded gullies and tailings piles that scar the surrounding landscape. During this period Symes was engaged in frequent conflict with a number of miners and government officials over access to water supplies. The locally influential Miller family, for example, complained to the Minister of Mines that Symes was diverting all of the water in the Loddon River. Officials discovered that Symes' race could in fact only carry 6 million gallons per day rather than the 15 million gallons to which he was legally entitled, and Symes was directed in 1905 to install a measuring gauge in the offtake at the head of his race.[51]

The complex conjunction of water races and water flows at Devil's Gully Tunnel also created difficulties. Symes was compelled in 1909 to allow 2 million gallons of water per week from the Fryer's Coliban race to flow *on top of* water in his by-law race and the tunnel.[52] Symes could not sell Coliban water, which was owned by the government but he did control access to it through his race, an anomaly of much concern to other miners and government officials. Symes also arranged to deliver Coliban water southward via a pipe *through* the tunnel, constructed in such a way as not to interfere with the northward flow. Tensions nevertheless rose high in summer months when water flows decreased, leading to accusations, arguments and physical assaults.[53] The main beneficiaries of all this conflict were local lawyers, J.W. M'Cay and W. Thwaites, who were engaged to draw up numerous water use agreements and represent the various protagonists in frequent court proceedings.[54]

By 1909 the Symes brothers' fortunes were waning, with floods damaging two of their dredges and the Sludge Abatement Board forcing compliance with directives over the Symes' mining wastes.[55] The Loddon race that James Symes held under Water

Right Licence No. 833 again fell into disrepair and he disposed of his share in the business to his brother, Mathew.[56] The latter continued sluicing but during the years of World War I there was little mining activity. Following further conflict over the water races in the early 1920s, the Department of Mines revoked Symes' easement over his by-law race, which allowed the State Rivers and Water Supply Commission to run water through the network.[57]

1930s Depression

Depression hit Victoria in 1930 and the year closed with the lowest gold yields on record. The depressed mining conditions led the government to offer assistance to parties of two or more miners under the Unemployed Relief Fund. They were loaned equipment, including a tent, pick, shovel, dish, a miner's right, railway pass and a *Guide for Prospectors*.[58] At Castlemaine, many turned to diggings and tailings that had not been thoroughly worked in the early days, especially around Chewton and Fryerstown. A state-wide mining revival ensued and the industry settled into a stable condition over the decade, with 1936 seeing the best gold yields since 1920.

Water at Fryerstown, however, was still an issue, with the erratic Coliban supply failing to meet demand. The system only supplied water to miners when a surplus was available and those at the end of the Fryer's channel often lost water to illegal diversions further up. Sluicers only received water after domestic and irrigation needs were met.[59] In this climate of depression and irregular water supply, the old Loddon race was about to be given a new, and final lease of life.

The Bradfield Syndicate

Arthur H. Bradfield was one of several miners keen to expand sluicing and dredging around Fryerstown in the 1930s but lack of water from the Coliban system restricted operations. In March 1937 he formed a syndicate with ten other miners to re-condition the Loddon race, or Loddon-Fryer's Channel as it had now become known. A re-payable grant of £1,500 was made via the Mines Department to upgrade the race, which was re-registered as Water Right Licence No. 1161 and the daily volume reduced from 15 million down to 3 million gallons (13.6 ML). A team of six men began removing leaves and cutting grass and rushes from the race. They also had to fill in rabbit burrows and cut out trees that had taken root, with the work completed by July 1937.[60] A descendant of the Bradfield family recalls that Arthur Bradfield also invested all the money from a large lottery win into the sluicing scheme.[61]

The most substantial renovation, however, involved constructing 14 large inverted siphons to replace the original timber fluming over gullies, most of which had burnt out in bushfires. Inverted (U-shaped) siphons are an ancient technology going back to at least the Roman era and work on the principle that water will rise to its own level. When water flows from an open channel into a pipe, however, there is a great increase in contact area and thus friction. To keep the water flowing, the terminal end of an inverted siphon must be sited lower than the entrance, so that in effect the siphon runs downhill.[62] Using a siphon thus means losing more height than an open channel.

Figure 6: *Siphon 13 of Loddon Company/Bradfield Syndicate water race*.

Source: Photograph by Co-author, Peter Davies

Each siphon was constructed from lengths of riveted steel pipe, delivered from a foundry in Castlemaine. The pipes were hot dipped and coated with bitumen in an on-site trough to improve their water-holding capacity and joined to each other with a pair of threaded steel hoops and bolts. The siphons were partially supported above ground level by timber trestles and small platforms of stacked granite, keeping the pipes well above the lowest part of the gullies. This protected the pipework from damage on the uneven terrain and lessened the depth of the siphons. The granite platforms were often linked by a pair of timber stringers or 'sets' up to 5 m long, to help anchor the piping above ground level. Trestles were constructed of timber hewn in the round and fixed with long nails and fencing wire. Sediment hatches were also inserted at intervals on the underside of the siphons to blow out accumulated sediment.

The longest siphon was 741 feet (226 m) in length at Boundary Creek, the shortest just 30 feet (10 m). The first 10 siphons featured 18-inch (46 cm) diameter pipes with the final four siphons 16 inches (41 cm) in diameter. A total of 3,898 feet (1188 m) of pipe were laid, with the water first turned into the race in September 1937.[63] Most of the siphons are well preserved in the forest today and although somewhat battered they are largely intact and provide good physical evidence for the scale of investment in water infrastructure and show how water was made to flow through the succession of pipes and race sections over more than 20 km.

The resurrected Loddon race was considered an asset to the mining community. The Syndicate supplied water from the Loddon-Fryer's Channel to 13 sluicing and dredging plants between 1938 and 1940 during another long drought and they were able to repay more than £500 on the loan. The Second World War, however, was a difficult

time as most miners were engaged in war work and little mining was done, so few payments were made for water.[64] In 1951 the remaining Syndicate members applied for the unpaid balance of £1,372 to be waived. The Chief Government Geologist (W. Baragwanath) and the Chief Inspector of Mines (G. Hadden) agreed, acknowledging that the original loan during the Depression was intended as no more than a sustenance payment similar to many others that were not expected to be repaid.[65]

With the lease on the race about to end the Syndicate reapplied for the water right licence, which was re-registered as No. 1214. Sluicing continued in gullies around Irishtown, causing major erosion clearly evident today. Dry years, however, reduced activity and by 1953 Ray Bradfield, son of Arthur, was the only Syndicate member still sluicing. Pipes were reconditioned and sluicing continued until 1958, but by 1962 the pipes were rusting and were not considered worth the effort to recover for resale. Ray Bradfield reluctantly closed the water network down, which was officially declared void in 1963, thus ending almost a century of water management from the Loddon River to Fryerstown.[66]

Conclusion

Previous research at Creswick and Beechworth has revealed the role of private investors in the supply of water to mining areas.[67] These individuals became water merchants, controlling and selling water for profit. At Castlemaine, however, several factors limited private investment in water schemes, including social resistance to large companies; physical, and thus economic challenges in constructing races to the area; and competition from the government's Coliban Scheme. There were thus few private water ventures established in the Castlemaine district, the main one being the Loddon Company.

The Loddon Company as a case study reveals the tight margins under which alluvial miners often operated. Private and government schemes at times charged exorbitant amounts for water. Many miners only eked out a living and the cost of water could be the deciding factor between continuing to mine and moving away to work elsewhere. Coliban water was not necessarily a cheap alternative. In 1878 water from the Coliban Scheme cost ½ penny per 1,000 gallons, slightly more than the Loddon Company charged. Charges for different water users also varied significantly. Water for quartz mining, for example, cost eight times more than water for sluicing purposes.[68] The price remained stable into the 1890s but dropped to ⅓ penny per 1,000 gallons during the early 20th century. The State Rivers and Water Supply Commission found in 1915 that increasing the cost of Coliban water from ⅓ penny to 1 penny per 1,000 gallons would send many miners broke,[69] and the price of water for sluicing thereafter remained stable for decades.

Despite the many years during which it delivered water, the Loddon Company's race was not a resounding success. This was partly because the Fryerstown area itself rapidly declined as a goldfield, compared to elsewhere in the Castlemaine district. By 1883 the experienced Mining Surveyor, Mark Amos, observed that 'the old workings are becoming exhausted and abandoned',[70] and in the following year 'even the old

timers are leaving'.[71] There were large amounts of clay and gravel to sluice away to access decreasing amounts of gold, with low returns and difficult terrain limiting options for water supply. The race required expensive upkeep and frequent modifications to ensure water flowed the right way to those paying for it, and often there was not enough to meet everyone's needs. The remains of this complex mining water system indicate that there was enough gold in the area for miners to hope and persist but not enough to generate much wealth. The end result for those concerned was hard work and heavy costs, in return for modest returns over many years.

Endnotes

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