

The Emuford Battery, North Queensland: a study in survival

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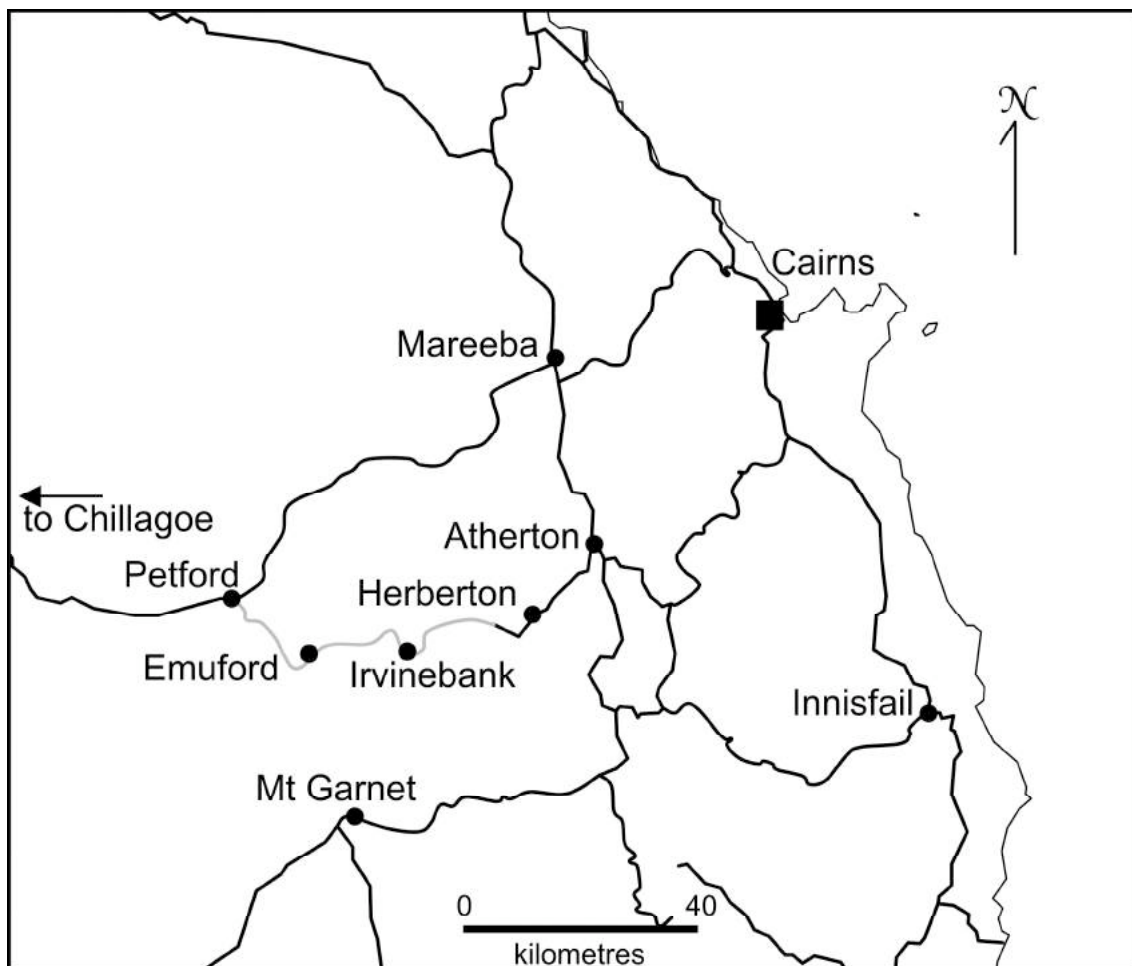
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The Emuford Battery crushed tin ore in the hinterland of Cairns, far north Queensland, between 1911 and 1985. It remains virtually intact, and is a museum of late nineteenth century and early twentieth century milling technology. Historic mill sites with such a high degree of intactness are uncommon, as most have been reduced to a few scraps of rusting metal. Discussed in this paper is the history of the mill, its physical characteristics and the ways in which the plant was modified over time and suggestions as to its remarkable state of preservation. Of these, the most important were: ownership by members of one family for much of its existence; the willingness of the State government to preserve it during periods when tin mining was not viable; and the poverty of the district that made modernisation of the plant too expensive. Finally, the heritage movement of recent years that has led to greater public recognition of mining heritage and conservation has ensured the battery's survival following the demise of tin mining in the district in 1985.

The Emuford Mill retains all of its plant. It has two generations of engines, one gas and one diesel, the charcoal retort for the suction gas engine, ore bins, rock breaker, stamps, classifiers, shaking tables, grinding pan, vanners, tin dryer, tool shop, tin weighing room, spare parts, forge, pumps, and the infrastructure to support them: dam, mill building, and domestic housing. It is rare for early mining sites to retain such a high degree of intactness, which no doubt explains why there is so little written on the reasons for their survival. It is instructive to examine other relatively intact battery sites in North Queensland for insights into the reasons for their state of preservation. According to Peter Bell, The Wild Irish Girl Mill on the Palmer, a three-stamp gold crushing mill which is also intact, has survived because of its isolation and continued use into the 1970s.¹ Batteries owned by Governments can survive relatively intact, due again to continued use into recent times, but are likely to be modernised and lose portions of the earlier machinery as did the Venus battery in Charters Towers, which changed from steam to electric power. The Irvinebank State Treatment Works similarly has survived and still has some early machinery, but it has been modernised and the

stamps replaced by rod mills. Experiencing a lesser degree of modernisation, the Kidston battery until recently enjoyed the protection of nearby townspeople. Now that the town is abandoned, it may suffer from theft and vandals. In other cases, plant that is mothballed by miners because of adverse conditions is later abandoned. If the site does not fall prey to scrap metal seekers it may last some time. However, any period of disuse will lead to deterioration, especially if the place is easily accessible. Bell suggests that the major threats to the survival of mine-sites are vandalism and theft, including collectors trying to preserve the machinery out of context; renewal of mining using open-cut methods; and natural processes such as decay, fires and termites.²

Figure 1: Location of Emuford and roads in the Cairns hinterland



Other heritage sites can contribute to understanding the issue. Rural properties such as Greenmount near Mackay in Queensland and Gulf Station near Melbourne, or businesses such as Brennan and Geraghty's Store in Maryborough, Queensland, survive

with little change and with interiors intact because of continuous ownership and use by one family.³

Yet another characteristic common to all these places since the 1970s has been recognition of the heritage value by owners or concerned members of the public. Brennan and Geraghty's was purchased by the National Trust of Queensland, which also took over and conserved the Venus Battery; Greenmount is now a museum, thanks partly to a fund established by the former owner; Gulf Station was purchased by the Victorian government following recognition of its heritage values by the National Trust of Victoria; and the Wild Irish Girl Mill has been watched over by local residents and the Palmer River Historical Preservation Society.

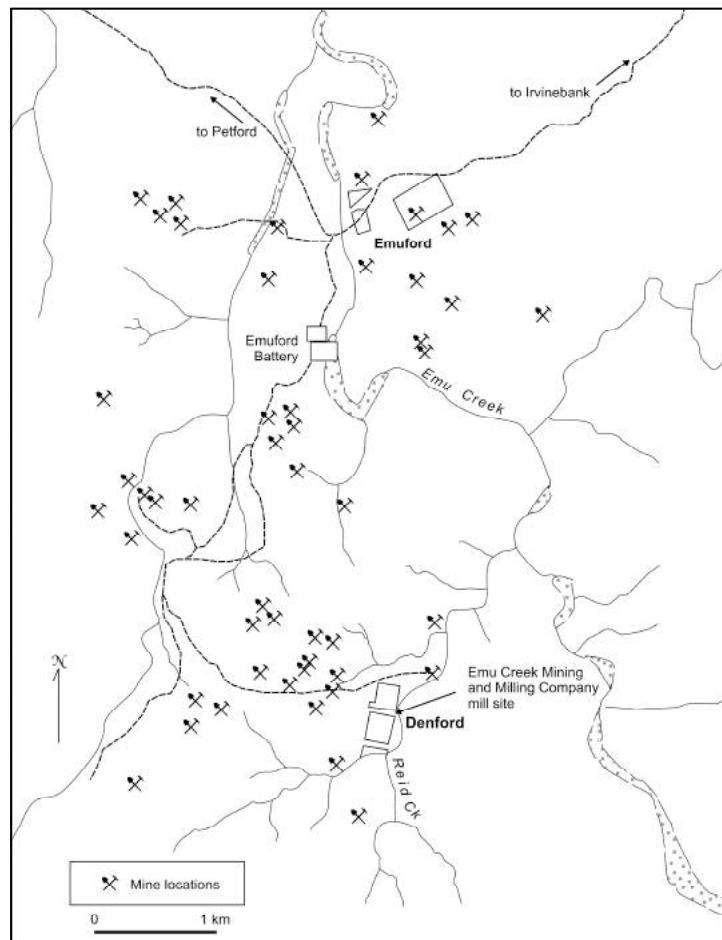
The Emuford mill was established on the western margins of the tin mining area surrounding Herberton and Irvinebank. Emuford was a small mining town, now abandoned, on Emu Creek, in the headwaters of the Mitchell River in the Cairns hinterland. The area is rich in minerals, producing tin, copper, silver, bismuth and wolfram. It was first prospected in 1882 by James Venture Mulligan who discovered tin, sparking a small alluvial diggings. Lode mining followed but the ore had to be carted some distance to be treated.⁴

One of the mining companies set up to exploit this area was the Emu Creek Tin Mining and Milling Co., which erected a ten-head battery nearby at the short-lived township of Denham on Reid's Creek in 1907-08.⁵ The company was assisted by an advance from the State Government of £1,450, under the Mining Machinery Advances Act of 1906.⁶ It failed – the mill seems to have worked for less than a year - and the plant was seized by the State government in November 1909. This was a common pattern for miners assisted by the Mining Machinery Advances Act and meant that the Mines Department gradually acquired a formidable array of equipment, which it sold or leased cheaply to new mining enterprises in the State in order to encourage the industry. The Emuford battery was sold in 1911 to Charles Frederick (Charlie) Green and John (Jack) Marvel for £700 on a hire purchase basis, paying £100 up front and the same amount each year. They moved the battery three miles (five km) north to Emuford.⁷

Emuford had become the centre of the district thanks to its position where a well-established road from Port Douglas to Georgetown and Chillagoe crossed Emu Creek. After 1899 the road was superseded by the Chillagoe Company's railways, leaving the town vulnerable to fluctuations in mining. The Green family was well represented in the town: Charlie Green also ran the butcher's store and hotel there at the

time and his brother Jack was the general carrier.⁸ Other establishments included a store, a school, and a combined store and post office, which was also owned by the Green family after 1917.⁹ The hotel burned down in 1916¹⁰ and by 1921 mining had declined to the point where all businesses and the school had closed. Thereafter, the town occasionally revived when tin prices were high and population was attracted back to the mines.

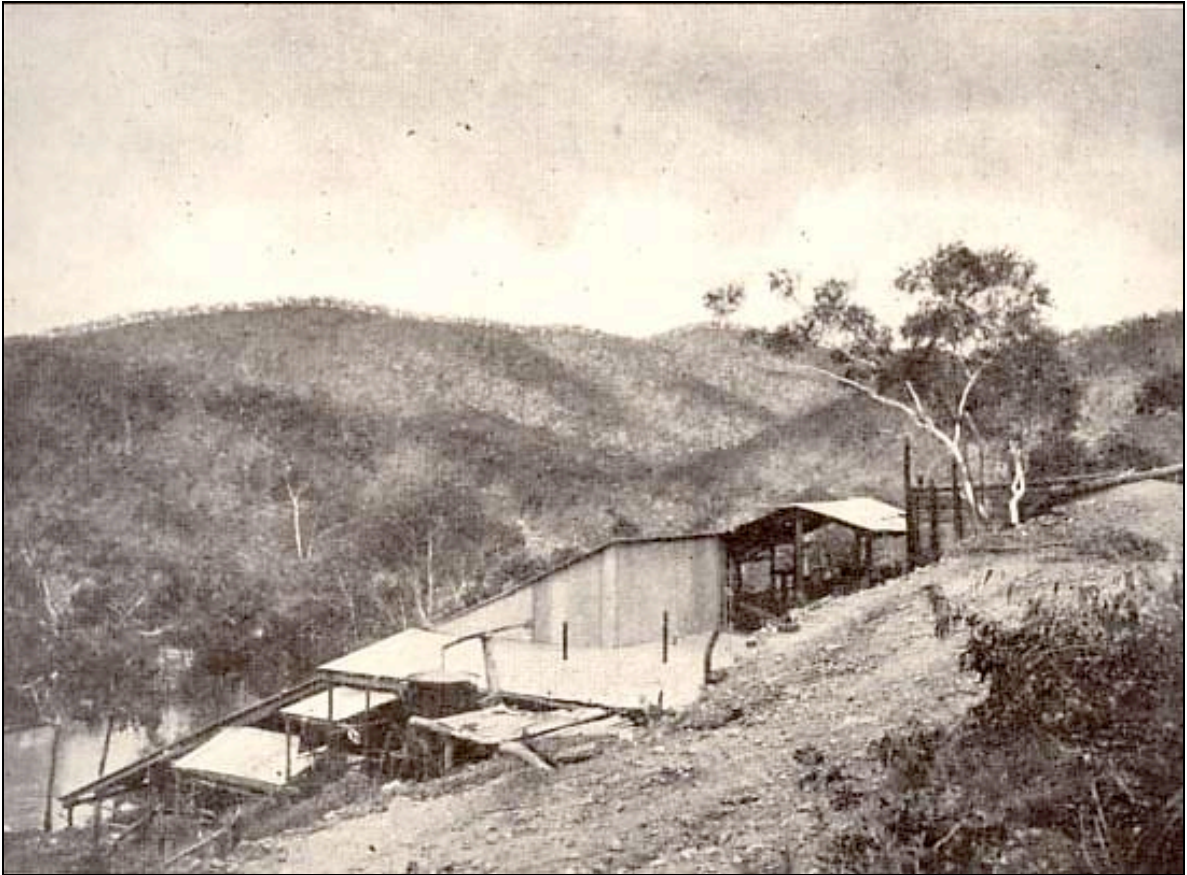
Fig. 2: *Emuford district Map*



Source: Based on Queensland Department of Mines map 'Emuford', 1966.

From the beginning, the battery was thought vital for the profitability of Emuford's tin lodes. Despite reports of rich 'slugs' of tin, on the whole the ore was low grade. Green and Marvel crushed ore for the public as well as from their own mines.¹¹ The battery's first effect on the town was to increase the population, but also make the creek water undrinkable because of pollution, and the residents petitioned the Government for a well.¹²

Figure 3: *Emuford battery in 1918.*



Source: *Queensland Government Mining Journal*, May 15, 1918, p. 200.

Most of the existing mill plant was installed at this point. To make the plant run more efficiently, a new 39hp Hornsby No. 5 suction gas plant was installed instead of the 40 hp Walkers single cylinder steam engine and Galloway boiler, left at Denham.¹³ The plant included the engine, gas producer and charcoal retort. A prefabricated battery shed was marked with Roman numerals for easy assembly. Detailed descriptions of the plant exist for 1920 and 1923, though these may include additions purchased after 1911. According to these lists, a Giant Crusher stone breaker reduced the size of the ore ready for the stamp battery. The battery had two sets of five 12-hundredweight (600kg) stamps with screw tappets. They were raised by steel cams and cam-shaft in an iron frame, and dropped into two mortar boxes which discharged crushed ore and water through screens set in their ends as well as the fronts. One mortar box carries the brand 'Walkers of Maryborough No. 134 1900'. Self-feeders brought the ore down at an even rate into the mortar boxes for crushing. Tin ore, in the absence of a smelter, was crushed and the tin 'concentrated' to remove waste material. The slurry of crushed ore was first put through classifiers to sort the larger and smaller grains and the larger grains were

ground further in two Wheeler pans, while the slimes were sent to the slimes tables. The crushed ore was concentrated on two Krupp shaking tables, a circular Sperry slimes table, and a double Luhrig vanner.

Figure 4: *Luhrig Vanner, Emuford mill*



Source: Photograph by authors

A 1922 list also mentions two Frue vanners as well as the Luhrig vanner, but as the present vanning plant consists of two Luhrigs, this may be questionable. The mill was unusual because most shaking tables used in the industry were Wilfley tables and most vanners in North Queensland were Frue vanners. Between treatment stages, the sands were settled ('thickened, or excess water removed) in six settlers. Concentrates were dried in an old boiler shell, bagged, and purchased by ore buyers for smelting. The machinery was run from the engine by belts on pulleys, and an acetylene gas plant provided lighting. Water was supplied from a waterhole below the battery in Emu Creek, though usually it only lasted for eight months of the year, and the water was piped to two 1,000-gallon [4,536 litres] tanks above the battery.¹⁴ Mill records indicate that tin, wolfram and bismuth ores were being treated¹⁵ and that the mill's crushing capacity was around one-and-a-half tons (1.52 tonnes) of ore an hour.

Severely disrupting mining and causing inflation, the First World War witnessed increased mining costs for spare parts and supplies. By 1919 the partnership was experiencing financial difficulties, compounded by drought, and later by poor tin prices.¹⁶

Figure 5: *Krupp Shaking tables, Emuford mill*



Source: Photograph by authors

In 1923 the battery was idle and the Mines Department was disputing Green and Marvel's right to remove and sell parts of the plant not included in the original purchase, including the engine. With £350 still owing, the mill was seized for non-payment of the loan. On behalf of the Silver Spray and Mount Hodges Company Ltd,¹⁷ it was then rented by former politician Thomas Glassey¹⁸ of Brisbane, with an option to purchase. The company wanted to move the mill to their mine, but an unfavourable report on the mine by the Inspector of Mines and its subsequent abandonment meant that by 1927 the battery was being seized again by the Department, for non payment of rent.¹⁹ At this stage Charlie Green offered to purchase the battery for £375 but failed to take up his option and subsequently in 1928, the battery was rented to Alex Renton and his partners, Henry Bird and son. They had an option to purchase for £400, with any rental money paid, to be credited to the purchase price.

Renton was experienced with machinery and tin milling and ran the battery, while the Bird's were in charge of mining. They intended to cart waste dumps left at the mines by former miners in the hope that with cheap transport and milling, the low-grade dumps or 'mullock' would pay.²⁰ Renton had his work cut out as the battery had not been worked for several years, so much of the plant had to be restored to working order, and much had also been dismantled by the Silver Spray company for removal.²¹ The Department assisted with a loan and spare parts. Even before the battery was ready to start in 1929 the partnership had dissolved and its mines were abandoned, leaving Renton to run the battery by himself, mainly for public crushings.²² He was willing to charge less than normal for crushing parcels of tin ore to encourage mining but as his savings had been spent in the process of getting the mill ready, he needed more Departmental support than they were willing to give in a depressed economic climate. For example, he needed £80 for a truck so ore could be carted cheaply to the mill but the amount was refused.²³ Renton struggled on for another year in the face of inadequate transport and poor tin prices, then accepted an offer by Charlie Green to take over the battery on behalf of the Emuford Tin Company. This had been formed to work several mines in the vicinity of the battery.²⁴

In 1930, the Mines Department agreed to the transfer, and the mill began crushing small lots of public ore as well as for the Company's own mines. The battery was renovated and a well and pump installed.²⁵ Not unexpectedly in the depths of a severe economic depression, the Company struggled, and for about two years from 1933 the battery and mines were let to tributors, W. Stephens, W. Whittaker and F. Simpson, who paid a percentage of their earnings to the company.²⁶ Stephens, the mill manager, improved the efficiency of the machinery and continued to improve the plant.²⁷ By this time it had a jaw crusher, ten-head of 1,100 pounds (approx. 500kg) stamps, two concentrating tables (the Krupp tables), two Luhrig vanners, pans, settlers, pumps, and a suction gas engine.²⁸ The list included Berdan pans but as it also mentioned mullers needed for the pans, these are more likely to have been Wheeler pans. Stone or iron weights used for grinding in Berdan pans were normally called 'drags'.

In 1936 the battery was taken over by John William (Jack) Green, Charlie Green's nephew, and Noel (Snow) Treseder on a royalty basis. As the battery only crushed intermittently, the Department finally decided to get rid of its continuing liability and put it up for auction. The Emuford Producers and Prospectors Association

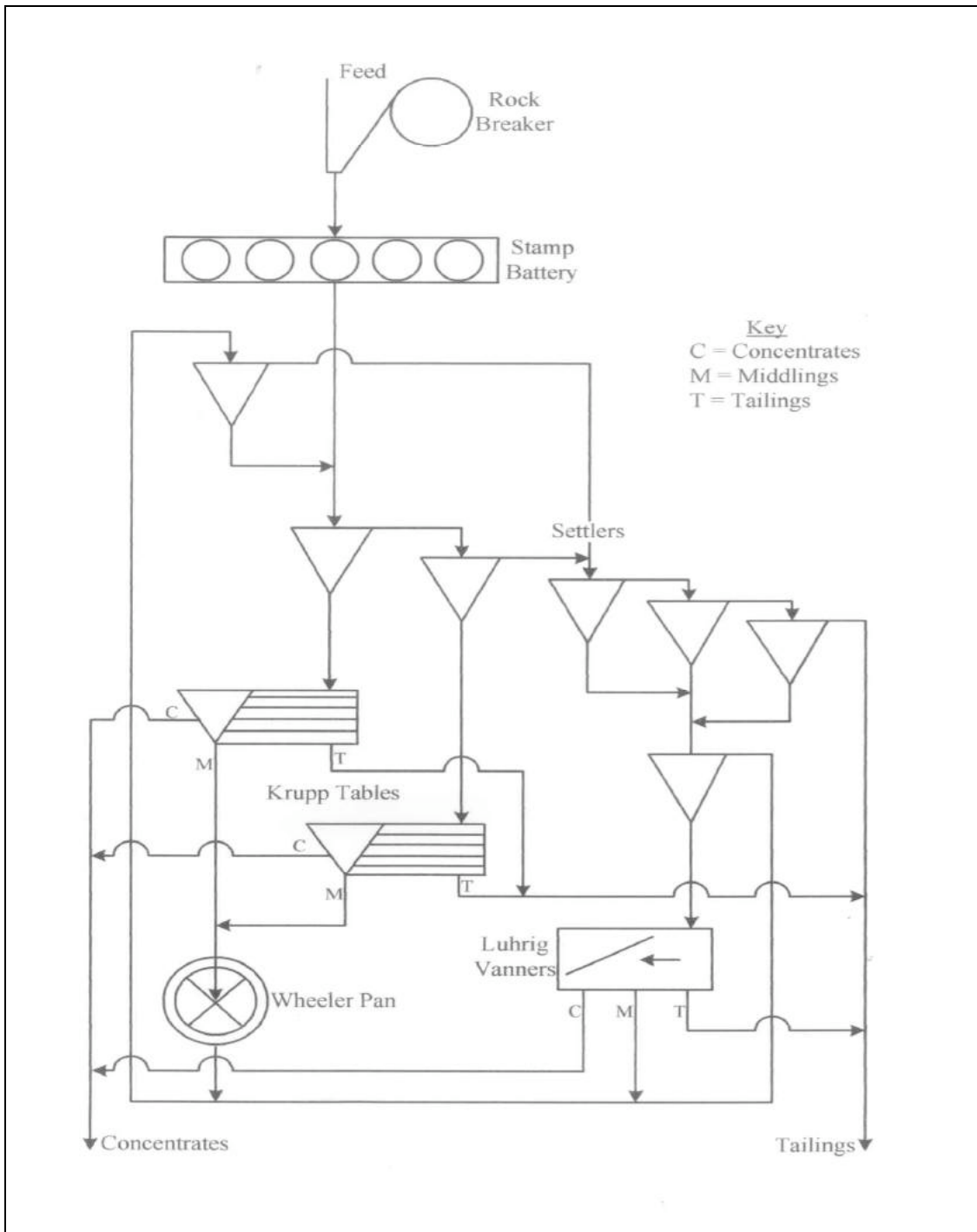
protested that the mill under Green and Treseder was at the highest standard of efficiency it had ever achieved. The auction went ahead regardless, but there were no bids; family tradition says that the district's miners made sure of that.²⁹ Green and Treseder's partnership lasted until 1945 when Jack Green ran the mill himself or with the aid of his family.

Unlike his predecessors, Jack Green made a success of the battery. In many years it ran intermittently on either public stone, or ore from his own mines when business was slack, but he purchased the battery and succeeded in paying off the debt. His son John commented dryly that when the final payment was made, the Mines Department office did not know how to process it because it was so rare for such debts to be finalised.³⁰ John William Green Jr. began helping his father in the mill when he was five years of age and at 13 years of age began working there full-time. He took over the mill when his father retired to Mareeba around 1980, and ran it until the price of tin collapsed in 1985. The mill was formally transferred to him in 1989 following his father's death in 1984.³¹

A description of the plant in 1959 shows little had changed. Ore was reduced in size by the jaw crusher before being sent to the ten-head battery. Often only five-head would be in operation, with fewer stamps if the ore was rich. The cams ran at 50 revolutions per minute, a fairly slow rate. Pulped ore was classified and sent to the concentrators. Coarser material was concentrated by the two Krupp shaking tables. The heaviest material discharged from the tables went direct to the tin drier, while the middlings or seconds were reground in a Wheeler pan and the results were again concentrated. Finer material went to the settlers and thence to two Luhrig vanners, which also received the finest discharge from the classifiers after it had been settled. Waste was discharged into the creek as tailings (see flowsheet, Fig. 6).

Although the circular slimes table was still in the mill, it was not in use. The lower Krupp table was rebuilt in 1957.³² A report on tin losses in the battery in 1959 recommended using the flotation process to deal with sulphides in the ore, so John Green built a plant in the early 1980s and added a Scott table to the concentrating plant.³³ Neither is in the mill today. The suction gas engine was underpowered for the work expected of it and in 1952 a Ruston Hornsby diesel engine was installed.³⁴ John Green recalled how pleasant it was to start an engine with the push of a button, as opposed to the lengthy process for starting the gas engine. He noted that the latter was hard work and that he was gassed a couple of times while charging up the plant.³⁵

Figure 6: Mill flowsheet 1959



Source: T.W.G. Brown, 'Tin Ore Treatment in the Herberton-Petford-Mt Garnet District of North Queensland', 1959. Unpublished report in Emuford Battery Collection.

Jack and John Green also made smaller improvements to the mill. They altered the concentrating tables at the battery from white metal bearings to ball or roller bearings so they ran more smoothly. Big mirrors were used over the concentrating tables so they could be watched from anywhere in the mill, allowing one or two men to

run the mill more easily. They brought in spare parts from elsewhere such as a lathe and drill (see Figure 7) from the Herberton battery [originally from the Chillagoe smelters], and belts from the Irvinebank battery. Second-hand screens were bought from sugar mills on the coast and repaired as mortar box screens. Power to the workshop was supplied from a 240 volt plant, an American two-phase alternator, which unfortunately proved incompatible with Australian electrical systems. It was replaced by a more standard 240 volt plant. The acetylene gas lighting was replaced by a 60 volt generator from a train. After the diesel engine was acquired, a 32 volt DC plant was installed. They tried to make the water supply last longer by building up the dam wall with dirt each dry season, but their efforts were often washed away in the 'wet'.³⁶ The mill was made quite efficient, so that when a company tested the tailings with a view to re-treating them, they found too little tin left to bother.³⁷ This undoubtedly confirmed the efficiency and thus the mill's popularity with the local miners.

Transport was needed. Jack Green had a 1932 two-and-a-half ton Bedford truck, bought new, used for carting timber for the mines and general work around the battery. It was sold in 1945 and replaced by a 1940 Maple Leaf army surplus truck. Later, Green bought a one-and-a-half ton 1932 Bedford, a lighter truck than the first.³⁸ This vehicle is still at the battery and has been restored to running condition by the current owner, John Fitzgerald. The road to the battery had to be repaired after each wet season and the Greens hired a mechanical excavator and driver for that task.

Near the mill was housing for the families associated with the battery. Jack and Agnes Green adapted the original manager's office building and added an extension in the early 1940s for Agnes' sister Emily after her husband died. It was benched into the hill and pipes drained away the water. The original manager's house had been further up the hill, but little of it remains today. A verandah was added to the main house, built around a mango tree and made L-shaped to avoid an orange tree, and a bough shed built next to it by John Green for pot plants and to help cool the area. The house was ceiled and the galvanized iron roofing replaced in 1973. Further renovations in 1980 included new asbestos cement sheet cladding, replacing the original galvanized iron, and louvre and hopper windows. Two more houses were built around the entrance to the mill, one for Treseder which was later purchased by John Green for his wife Hazel, herself the daughter of a tin miner, and their family. It no longer exists. Later, John Green built the second house for his sister Daphne and her husband David Perkes.³⁹

Figure 7: *Drill and lathe, Emuford mill*



Source: Photograph by authors

Infrastructure put in for the convenience of the mill and its residents benefited everyone in the local area. John Green strung a telephone wire with ceramic insulators from tree to tree to Petford, the nearest town, with the telephone in the main house, and

the Government later supplied and maintained a phone box placed on the verandah. John Green recalls queues to use it of up to 30 people. The truck did the weekly mail run from Petford and a dozen people would meet at the mill or the Tree of Knowledge in the town to collect their mail. This truck also took people into Petford for dances. The Greens owned the first kerosene refrigerator in the area, storing meat for local miners. Kerosene lighting was also used at this stage in the house. Later, after the 240 volt generator was installed, a freezer was added, as well as a washing machine to replace the traditional copper. The earlier 32 volt power supply used to light the mill also ran other appliances. Visitors came to picnic at the dam, a popular swimming hole. Other entertainment included the only wireless in town before the war, and a billiard table that was very popular until the betting and resultant brawling became too much for the family. Sporting matches were also held at the mill. The Greens also hosted a meal for the district each Christmas Eve, feeding 60-70 people at a time and in one year that number reached about 120.⁴⁰

On 24 October 1985, world tin prices crashed. The last crushing at Emuford, 20 tonnes of ore, was put through for local miner McEwen before the mill stopped for good on 7 January 1986. John Green had just invested \$20,000 in equipment to work the local mines. He went gold mining on the Palmer, leaving a caretaker in charge. When he returned, he found valuable furniture dating from the turn of the century had been vandalized and was in danger from termites, so it was sold, as was the telephone box. Possessions, both at the house and the mill, were disappearing. His family's long association with the mill made him reluctant to sell it piecemeal. However, being close to the Irvinebank-Petford road there is no doubt that over time it would have slipped into ruin without an owner on site. Fortunately the outstanding heritage value of the mill was recognised by John Fitzgerald, himself a former miner, and John Green was happy to sell it into his hands. John Fitzgerald has been conserving the mill and associated equipment, and re-acquiring important items sold earlier, such as the original steam engine. He hopes that it will become self-supporting from the tourist trade as a mining museum.⁴¹

The Emuford battery and its nineteenth century technology have managed to survive into the twenty-first century thanks to an unusual set of circumstances. It was an early example of a mill set up with State government assistance under the Mining Machinery Advances Act. This ensured that in the inevitable depressions caused by dropping metal prices, it fell into the hands of the Department of Mines which

financially assisted its owners and operators in order to support mining in the district. However it never became a State-run battery and hence avoided the modernisation that often occurred in recent times with such batteries. Low-grade ores and the general poverty of the district offered little incentive to upgrade. The long association of the Green family with the mill meant that it had a set of owners familiar with its operations and more interested in getting the most out of the existing equipment than modernizing. That long association also cemented their attachment to the mill as an important historical artefact and as their home. This ensured that the last Green family member to own it made sure it was sold to someone who recognized the historical value of this extraordinarily intact mill.

Endnotes

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⁴ R.S. Kerr, *John Moffat's Empire*, J. & R. Kerr, St Lucia, 1979; Report of the Under-Secretary for Mines for 1907, *Queensland Parliamentary Papers* [hereafter *QPP*] 1908, p. 74; interview with John Green, 7 February 2005.

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⁶ Register of Mining Machinery Advances 1907-1936, p. 2, RSI 1460, Queensland State Archives [hereafter QSA].

⁷ Report of the Under-Secretary for Mines for 1911, *QPP* 1912, p. 807.

⁸ *Queensland Post Office Directory*, 1908-1917.

⁹ Reports of the Queensland Department of Public Instruction 1912-1916, *QPP* 1913-1917; *Queensland Post Office Directory*, 1917-1921.

¹⁰ *Queensland Post Office Directory*, 1916, 1921-1924.

¹¹ Report of the Under-Secretary for Mines for 1910 and 1911, *QPP* 1911, p. 360 and 1912, p. 716; interview with John and Hazel Green, 2003.

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¹³ Report of the Under-Secretary for Mines for 1911, *QPP* 1912, p. 807.

¹⁴ Inventory and valuation of plant, 10 May 1923, and Warden, Herberton to Under-Secretary for Mines, 26 August 1922. Emuford Battery file [hereafter EBF], RSI 1356-1-27, QSA; E.C. Saint-Smith, 'Report on Green and Marvel's Tin Properties, Emuford', *Queensland Government Mining Journal*, vol. 21, no. 10, 15 October 1920, p. 419.

¹⁵ Battery crushing records for 1918, Emuford Battery Collection [hereafter EBC], located at Emuford mill.

¹⁶ C.F. Green to Under Secretary for Mines, 14 June 1919, 24 September 1919, 10 January 1921, EBF, QSA.

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- ¹⁷ Inspector of Mines, Mareeba to Under-Secretary, 10 September 1923; Under-Secretary to Inspector of Mines, 9 October 1923, Under-Secretary to Solicitor-General, 5 January 1924, Under-Secretary to Inspector of Mines, 12 March 1925, EBF, QSA.
- ¹⁸ See entry for Glassey in D.B. Waterson, *Biographical Register of the Queensland Parliament, 1860-1929*, Casket Publications, Sydney, 2001, p. 74.
- ¹⁹ Under-Secretary to Inspector of Mines, 4 January 1927, Inspector of Mines to Under-Secretary, 29 June 1928, EBF, QSA.
- ²⁰ Report of the Under-Secretary for Mines for 1929, *QPP* 1930, p. 1295.
- ²¹ Inspector of Mines to Under-Secretary, 29 June 1928; Alex Renton to Under-Secretary, 23 August 1928; Under-Secretary to Inspector of Mines Mareeba, 28 September 1928, EBF, QSA.
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- ²⁹ Neville Powell, Emuford Producers and Prospectors Association, to Dept of Mines, n.d., EBC; interview with John Green, 2003.
- ³⁰ See for example reports of the Under-Secretary for Mines for 1939 in *QPP* 1940, p. 244; for 1940 in *QPP* 1946, p. 223; for 1949 in *QPP* 1950, p. 46; for 1955 in *QPP* 1956, p. 31; interview with John Green, 2003.
- ³¹ J.W. Green Jr to Warden, Herberton, 1989 (date incomplete), EBC; interview with John Green, 2003.
- ³² Interview with John and Hazel Green, February 2003; plans dated November 1956 to July 1957, EBC.
- ³³ Interview with John and Hazel Green, February 2003; interview with John Green by Justin Lambert, 2003.
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- ³⁵ Interview with John Green, 2003; *Sunday Mail and Guardian*, 8 October 1939, p. 10.
- ³⁶ Interview with John Green 2003.
- ³⁷ Interviews with John Green and Brian Perkes, 2003.
- ³⁸ *Ibid.*
- ³⁹ *Ibid.*
- ⁴⁰ Interview with John and Hazel Green, 4 February 2003.
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