Thematic History

Fitz Roy Iron Works,

Mittagong

View north across the Fitz Roy engine and flywheel pits towards the tilt hammer pit. The rolling mill footings are on the left. (February 2008)

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Thematic History

This thematic history was prepared as part of the development of a Conservation Management Plan for the Fitz Roy Iron Works in 2007. A variety of published works and some original research were drawn upon to illustrate the historic themes relevant to the Fitz Roy Iron Works. Four published accounts of the development and failure of the iron works at Mittagong have provided much of the information generally available about this site.

In its most developed operational configuration the Fitz Roy Iron Works consisted of three spatial elements:

A. A brickworks, including a Chilean mill and kilns, recorded by Godden Mackay Logan and now destroyed. This was the most westerly part of the complex.
B. A group of structures and machinery for processing iron. This included puddling furnaces, a tilt hammer and rolling mills. This area is the subject of this Conservation Management Plan.
C. A blast furnace and ancillary buildings, including workshops and a foundry, located 250 metres east of the iron processing site.

Supplementary facilities and linked features include a tramway and incline connecting the complex to the Nattai coal mines, Lake Alexandra and the townscape of New Sheffield. This thematic history attempts to identify the story of the development of the iron processing site (Site B) within the general context of the development of the enterprises that operated the complex.

1.1 Developing Local, Regional and National Economies - Industry

Like most colonial Australian iron-making ventures the Fitz Roy Iron Works was located to exploit a known iron ore deposit. The prospect of smelting native iron ores had been considered as early as 1801 when H. Vernon, Manager of the Fentley Iron Works in England, expressed interest in erecting an iron works in New South Wales. This was regardless of the fact that local ores known at that time had proven unsuitable for smelting.[1] Although he never established a smelting works Vernon's interest represented the first flush of an optimism that would lead many entrepreneurs into ill-considered ventures in the colonies. Among other things unsuitable chemical composition of ores would plague a number of nineteenth century Australian iron-making ventures.

Issues other than the quality of ores were to plague the Mittagong venture. While surveying a new alignment for the Great Southern Road in 1833 'Surveyor Jacques discovered the large iron ore deposit' and sent specimens to the Surveyor General. 'The ore body was in fact cut by the new road alignment.'[2] According to Jack and Cremin 'the deposit was substantial, of apparently good quality'[3].

When local landowner John Thomas Neale and Thomas Holmes, 'backed by Sydney money'[4], established 'a Catalan forge, two beam engines and a cupola furnace'[5], at

[1] McKillop, B. et al., 2006. *Furnace, Fire and Forge*. p.14
[2] Godden Mackay Logan, 2005, Mittagong Marketplace – Archaeological Assessment and Research Design. p.8
[3] Jack, R. I. & Cremin, A, 1994. *Australia's Age of Iron*. p.16
[4] Jack, R. I. & Cremin, A, 1994. *Australia's Age of Iron*. p.16

Nattai in 1848 the potential problems of isolation from markets, cost of fuel supply and the swampy ground chosen for the works were not considered. All of these factors would hamper the efforts of various groups to successfully operate the works and would eventually lead to their demise.

This venture was the first in New South Wales to smelt native Australian iron ores using locally made charcoal. According to Johnston-Liik et al the first attempts to smelt Australian iron ore were made in South Australia. They note accounts of a blacksmith at Mount Barker producing 'metal of an excellent quality from local ores' in 1847, and the erection of a smelting works at Cox's Creek near Hahndorf in the same year[6]. It appears clear, however, that the Nattai site was the first to smelt iron ore on a commercial basis.

The Nattai ore proved to be easily worked and produced high quality iron. It possessed a rare quality of earthy matter that readily separated from the ore when smelted. This obviated the need for the use of a flux in the smelting process. Despite the high quality of the product the limitations of fuel supply and the capacity of the works appear to have limited the quantities of iron that could be produced[7].

> *The partners formed the Fitz Roy Iron Mining Company and appointed trustees. By 1852 a puddling furnace was installed, a shop erected and the land was fenced. Houses for the workers were built. English experts declared that the iron was a valuable component for making machinery. Coal was transported from Black Bob's Creek, near Berrima, and distance was a problem.*[8]

To facilitate expansion of the works the Fitz Roy Iron and Coal Mining Company was incorporated in 1854 with additional capital. Productivity at the works appeared to be an elusive goal and 'only three tons of wrought iron had been produced up to 1855'.[9]

Despite expansion of the works during the 1850s bickering between directors drove it to a standstill. The coming of the railway was thought to be the answer to many of the difficulties which beset the iron works, by providing not only a ready market in the form of rails, but also cheap transport. Chairman F. J. Rothery heavily mortgaged the works in 1854 to assist with cash flow. In 1856 rolling machinery was ordered to enable the company to compete for government contracts to produce rails but by then the company was in serious financial trouble.[10]

Rothery resigned from the board and tried to foreclose on his mortgage. All work ceased until an agreement could be reached. The company was reorganized several times and restructured in 1859 as the Fitz Roy Iron Company Ltd. Rothery's death in 1860 delayed settlement of these matters.[11]

Despite problems with the location of the works and trouble amongst directors, investors continued to express confidence in the venture.

> *With the extension of the Great Southern Railway approaching Mittagong, interest in the works was revived and … the venture was reformed as the Fitz*

[5] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. pp.14-15
[6] Johnston-Liik, E., et al, 1998. *A Measure of Greatness*. pp.4-5
[7] Jack, R. I. & Cremin, A, 1994. *Australia's Age of Iron*. pp.16-17
[8] Day, L., 2006. A Selective History of the Fitz Roy Iron Works.
[9] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.15
[10] Johnson-Liik, E., Liik, G. & Ward, R., 1998. *A Measure of Greatness*. pp.10-11
[11] Day, L., 2006. A Selective History of the Fitz Roy Iron Works.

> *Roy Iron Works Company in 1862-63. Prominent new investors became shareholders, including John Keep a leading Sydney ironmonger, and Sydney merchants, John Frazer, Simon Zollner, and Ebenezer Vickery, a manufacturer of footwear and leather goods.*[12]

In 1863 the works were leased to Melbourne businessman Benjamin Lattin. Lattin engaged immigrant ironworker Enoch Hughes to manage the works and oversee the erection of a new blast furnace on a site to the east of the iron works. The Sydney Morning Herald described the venture in June 1863:

> *There are at present about seventy men employed upon the various works which comprises the coal mines, the quarries and brick making. A tramway of two and a half miles connects the work with the coal mines … A blast furnace and engine house are in the course of erection the masonry of which is of a very substantial character … At a short distance below these are the puddling furnaces and the rolling stock for the manufacture of bar iron, railway bars and boiler plates, and a new 60h.p. engine all of which are ready to use.*[13]

The blast furnace, of obsolete design, proved initially to be a failure and substantial reconstruction and drainage works were required. The demand for capital required by Lattin's expansion works, the failure of the blast furnace, and disputes with Enoch Hughes regarding the management of the enterprise, led Lattin into severe financial difficulties.[14]

By April 1864 the shareholders moved to take over the works and engaged new English expertise to improve the operation of the blast furnace. After various unsuccessful attempts the blast furnace was brought into production and produced 2,394 tons of pig iron in 1865-66 before being shut down. Despite this apparent success the business struggled and the late 1860s saw various attempts to create a viable business at the site. These included an attempted partnership with P.N. Russell & Co. under the banner of the Fitzroy Iron Works Company in 1866, lease of the rolling mills to Enoch and William Hughes in early 1868 and lease by Bladen and Company later in the same year. '… the Fitzroy Iron Company's board, weary of technical problems and the stop/start history of operations, resolved to wind-up the concern in November 1869.'[15]

A world-wide iron boom, increased prices for British pig iron, and economic growth in Australia during the 1870s led to the establishment of many new iron-making ventures in this decade[16]. During this period works were established at Eskbank (Lithgow), Redbill Point, Tasmania, Lal Lal, Victoria and various other places in the Australian colonies (Refer to **Figure 1)**.

This decade's 'iron rush' saw renewed interest in the Fitzroy Works with a new English-based company, the Fitzroy Bessemer Steel Hematite Iron and Coal Company, leasing the site from 1873. Shareholders of the Fitzroy Bessemer Steel Hematite Iron and Coal Company included John Frazer, Ebenezer Vickery and Simon Zollner[17]. Unable to successfully operate the works in a competitive environment this

[12] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.15
[13] Godden Mackay Logan, 2005, Mittagong Marketplace – Archaeological Assessment and Research Design. p.10
[14] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. pp.16-17
[15] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. pp.16-17
[16] Johnson-Liik, E., Liik, G. & Ward, R., 1998. *A Measure of Greatness*. p.26
[17] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.17

venture relinquished its lease in early 1877.[18] A lease was taken up briefly by E.G. Larking, Hunter and Henshaw to roll rails from stockpiled pig iron in 1877[19].

The works lay idle until it was leased by William Sandford who had secured a contract to re-roll 12,500 tons of rails for the NSW Government over a period of five years. Sandford engaged Hughes as works manager in March 1886 and dispensed with his services four months later.[20] Before leasing the Fitzroy mills Sandford, who had established Australia's first wire netting manufacturing plant on behalf of John Lysaght Ltd, had attempted to convince his employers to purchase the Eskbank ironworks in Lithgow. When they did not support his proposal he resigned and took up his lease of Fitzroy. Rapidly becoming aware of the shortcomings of the Fitzroy site Sandford moved his contract to Eskbank in early 1887.[21]

Two subsequent attempts were made to resurrect the works. Alfred Lambert went bankrupt attempting to roll rails at the site in 1896. 'In the early 1900s Daniel Flood dismantled the works and the machinery was melted down in Sydney. Flood purchased modern equipment to operate works but the venture failed.'[22]

The ironworks established at Nattai in 1848 was a testament to the vision of colonial entrepreneurs who saw the potential of smelting Australian iron ore to feed the demands of a growing economy. Undercapitalisation, poor transport links, problems with fuel supply and inappropriate siting of the works on swampy ground hampered the development of the enterprise. When added to the chronic colonial industrialists' dilemma of cheap British imports and the free trade policies of successive New South Wales governments these issues virtually assured the failure of the Mittagong venture.

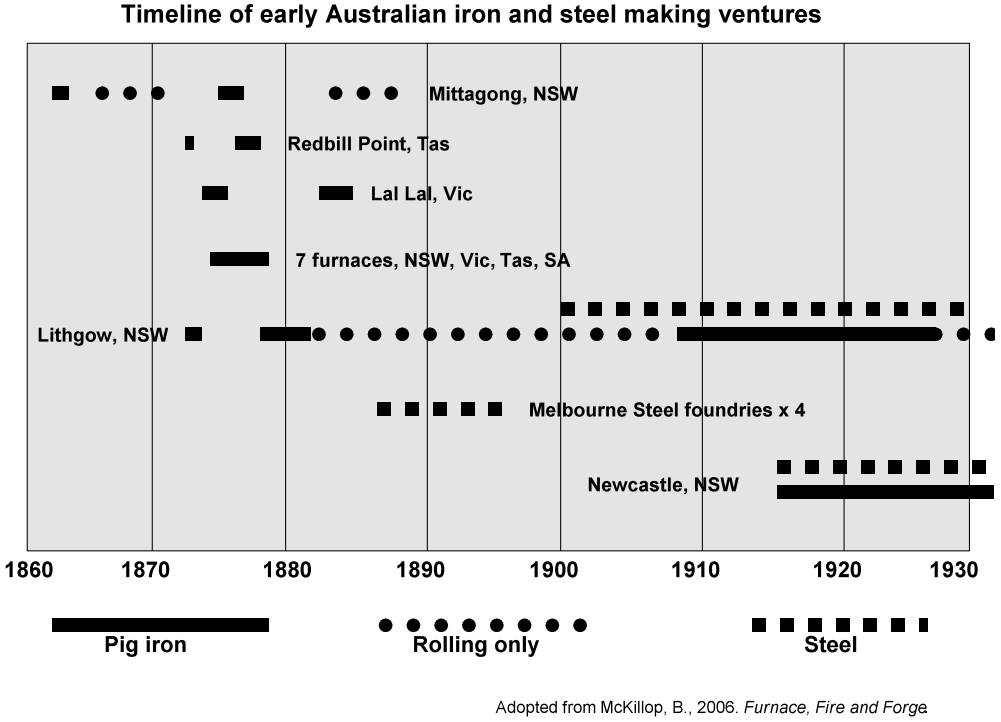

Figure 1: 19th century Australian iron making timeline.

[18] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.18
[19] Godden Mackay Logan, 2005, Mittagong Marketplace – Archaeological Assessment and Research Design. p.12
[20] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.18
[21] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.81
[22] Day, L., 2006. A Selective History of the Fitz Roy Iron Works.

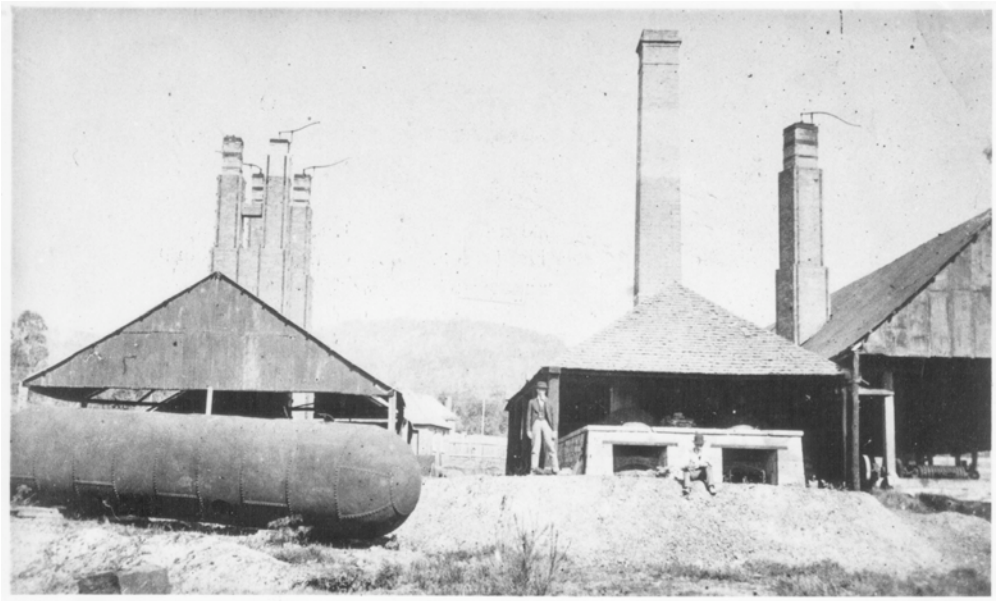

Plate 1: The northern side of the iron works in the 1870s. This photograph shows much of the area covered by this Conservation Management Plan, including the stone boiler cradles (Features 18 & 19) and sections of the puddling furnaces (Features 7 & 8). The egg shaped boiler was possibly removed from Feature 27 The presence of an apparently stored bar or slitting roll to the right of the boiler cradles suggests that this photograph was taken during the reconstruction of the rolling mill footings.
(Photo courtesy State Library of New South Wales)

The Fitz Roy Iron Works was not only the first of its kind in Australia, it proved to be a meeting and testing ground for a variety of persons who would go on to become key players in the development of a viable iron and steel industry in Australia.

Plate 2: The southern side of the iron works in the 1870s. This photograph shows much of the area covered by this Conservation Management Plan, including the puddling furnaces (right) and rolling mills (left of centre).
(Photo courtesy State Library of New South Wales)

1.2 Developing Local, Regional and National Economies - Technology

Existing accounts of the iron works at Mittagong identify ongoing investment in plant and machinery upgrades as differing groups of investors and managers attempted to

create a profitable enterprise. Most of these accounts focus on the relatively well-documented saga of the Mittagong blast furnace. They also focus on the obsolete design, poor construction and apparent ill-considered placement of the furnace that necessitated the excavation of supplementary drains, later construction of hot blast stoves, replacement of refractory bricks and supplementing the structure of the furnace.

McKillop particularly reflected on the obsolescence of the design of the blast furnace erected under the supervision of Enoch Hughes in 1863. This design was typical of those constructed in England's Black Country in the 1830s. The application of this design has been dated back to the 15th century[23]. It included none of the innovations of hot blast, first tested in Scotland in 1828, downcomers, introduced in the 1830s and closing of blast furnace tops, introduced from the 1850s[24]. It reflected the superseded knowledge and experience brought to the Australian colonies by immigrants with limited experience in British industries.

The efficiency of the entire works appears to have been severely constrained by a number of factors, including:

- The boggy and flood-prone nature of the site chosen for the furnaces, tilt hammer and rolling mills,
- The purchase of obsolete or obsolescent machinery that reduced the efficiency of work processes,
- The inability of the different enterprises involved to locate economic sources of fuel.

When establishing a smelting works in 1848 Neale and Holmes erected a Catalan forge (described by Else-Mitchell as a blast furnace), two beam engines[25] and a tilt hammer. Else-Mitchell noted that one beam engine worked the fan (or possibly bellows) for the forge[26]. The second beam engine may have driven the tilt hammer.

With the exception of the beam engines the arrangement described by Else-Mitchell reflects a very traditional pre-industrial[27] iron-making establishment. Catalan forges had been in use:

> *... for about a thousand years in southern Europe. They were a traditional preindustrial method of making iron ... Their capacity was small and each charge produced a lump (or loupe) of crude iron weighing up to 350 pounds*.[28]

The fuel source for the small capacity forge was green timber cut from the lands around the ironworks. About two and one-half tons of iron were manufactured prior to the failure of the tilt-hammer[29]. Prior to this failure a stone quarry and brickfield were established in 1849[30].

The capital investment by the initial consortium exploiting the Nattai iron ore deposit was £10,000[31]. This represents an enormous contrast with the capital investment of

[23] Palmer, M. & Neaverson, P., 1998. *Industrial Archaeology. Principles and Practice*. p.47
[24] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.272
[25] Else-Mitchell, R., 1981. *Early Industries in the Mittagong District*. p.4
[26] Else-Mitchell, R., 1981. *Early Industries in the Mittagong District*. p.4
[27] Johnson-Liik, E., Liik, G. & Ward, R., 1998. *A Measure of Greatness*. p.7
[28] Johnson-Liik, E., Liik, G. & Ward, R., 1998. *A Measure of Greatness*. pp.6-7
[29] Else-Mitchell, R., 1981. *Early Industries in the Mittagong District*. p.7
[30] Else-Mitchell, R., 1981. *Early Industries in the Mittagong District*. p.4
[31] Else-Mitchell, R., 1981. *Early Industries in the Mittagong District*. p.7

£200,000 made by the Fitz Roy Iron and Coal Mining Company[32] in 1852. The massive difference in capital investment provides a reflection on the apparently primitive establishment created by Neale, Holmes and the Tipple Smiths in 1848.

According to Else-Mitchell the Fitz Roy Iron and Coal Mining Company purchased rolling mills from England, and installed new steam engines to drive the mills and a tilt hammer[33]. The rolling mills were manufactured by Thomas Perry & Sons of Bilston, South Staffordshire and were installed by Henry William Johnson in 1857[34].

The choice of rolling mills reflects the same tendency towards obsolescence shown in the later construction of a blast furnace. The 1869 Town and Country Journal lithograph of the rolling mills in operation (refer to **Plate 3**) depicts two-high mills with rolled bars being passed back over the mill rolls for re-working. As early as 1815 two-high mills had been rendered obsolescent by three-high rolling mills introduced in ironworks in Staffordshire. According to Gerry Platt:

> *The three-high mill has three rolls mounted in the frame, permitting bars to be passed through them in both forward and reverse directions without the need for a non-rolling pass back over the top roll, increasing the productivity of the mill.*[35]

[32] Else-Mitchell, R., 1981. *Early Industries in the Mittagong District*. p.9
[33] Else-Mitchell, R., 1981. *Early Industries in the Mittagong District*. p.9
[34] McKillop, R. et al, 2006. *Furnace, Fire and Forge*. p.15
[35] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.273

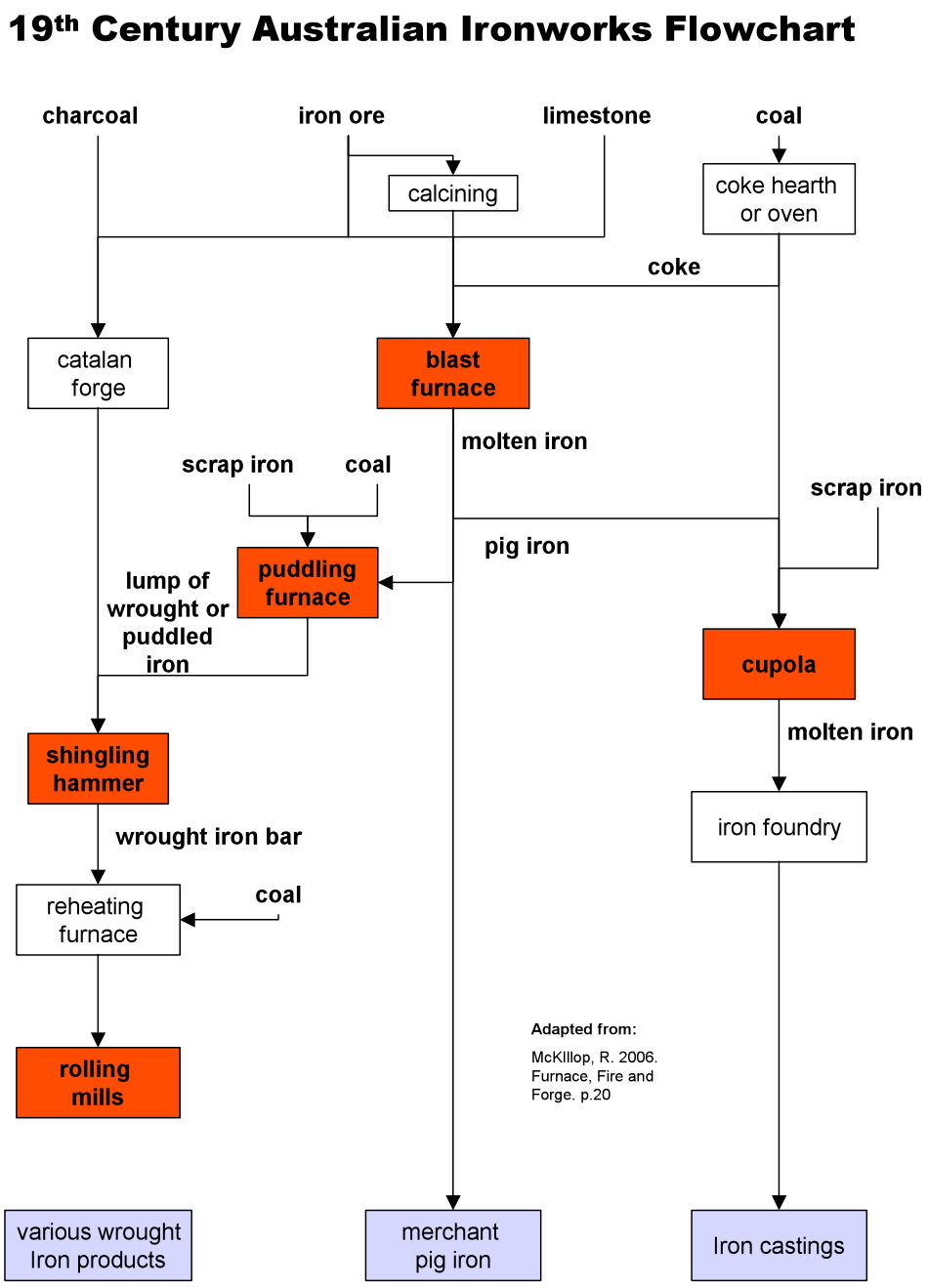

Figure 2: Flowchart of 19th century iron making showing the various processes and plant used for smelting and processing iron. All of these processes appear to have been applied at Mittagong.

The purchase and installation of two-high rolling mills as late as the early 1850s is further evidence choices of superseded and relatively inefficient process machinery and systems. These choices severely affected the performance of the Fitz Roy Iron Works.

By 1859 the works 'had become a complex iron smelting and manufacturing centre'[36]. In 1856 the Argus described the installation of machinery as follows:

> *Already a twelve horse power engine and boiler has been erected which by means of gearing, is made to work the tilts, squeezer, and a large hammer of*

[36] Johnson-Liik, E., Liik, G. & Ward, R., 1998. *A Measure of Greatness*. p.12

> *five tons weight. A forty horse power engine is also in the course of erection to work the rolls which have lately arrived from England, and which consist of a set of roughing and merchant rollers, and a set for railway bars*.[37]

The forty horsepower engine appears to have been manufactured by P.N. Russell & Company of Sydney[38].

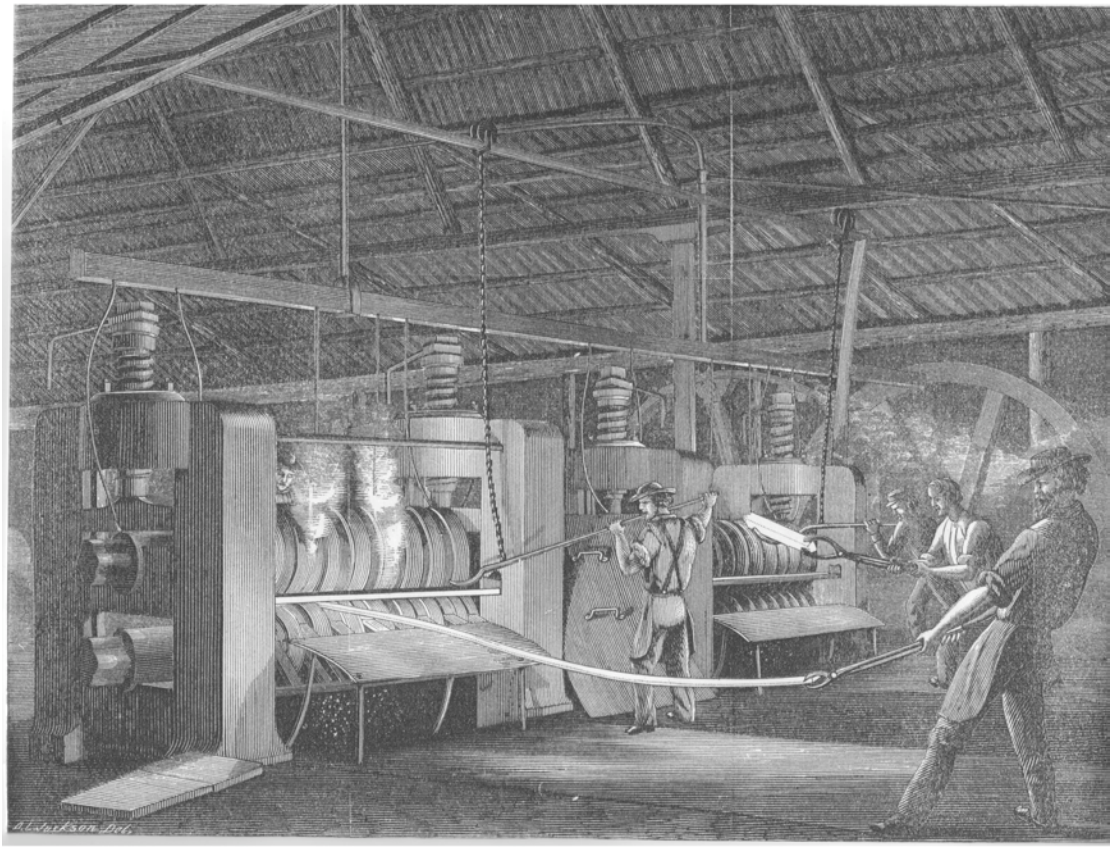

Plate 3: Rolling mills in 1869 with the fly and drive wheels in the background. (Image courtesy State Library of New South Wales)

The consortium involved in the 1850s improvements to the Fitz Roy Iron Works dissolved in litigation and acrimony with allegations of mismanagement (refer to **Section 1.1**). Strangely during the upgrading works Superintendent of Works William Povey, who was concurrently conducting a business on site selling goods to employees, sold a tilt hammer to the consortium[39]. These actions call into question the purchasing policies of the company during this period of expansion.

The next phase of large capital investment and upgrading appears to have occurred under the control of Benjamin Lattin from 1863. A Sydney Morning Herald report of July 1863 noted that Lattin presided over a plant including puddling furnaces, rolling mills with a new 60hp engine, and 'three cupolas erected for melting the ore'. Johnston-Liik et al described the cupola furnaces used at Mittagong as follows:

> *The cupola furnaces at Mittagong resembled stumpy, round chimneys encased in iron plates, perhaps twelve feet high and less than three feet diameter.*

[37] Godden Mackay Logan, 2005, Mittagong Marketplace – Archaeological Assessment and Research Design. p.10
[38] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.15
[39] Day, L., 2006. A Selective History of the Fitz Roy Iron Works.

Charge materials were fed into the top and a blast of air provided by a small steam-driven engine was blown in near the bottom.[40]

The source of this description is not acknowledged by the authors. Cupola furnaces were generally used to re-process pig iron from blast furnaces as part of the process of making iron castings[41]. Cupola furnace footings were excavated from the eastern section of the Fitz Roy Iron Works site. Cupola furnaces were also installed as part of the foundry established near the blast furnace[42].

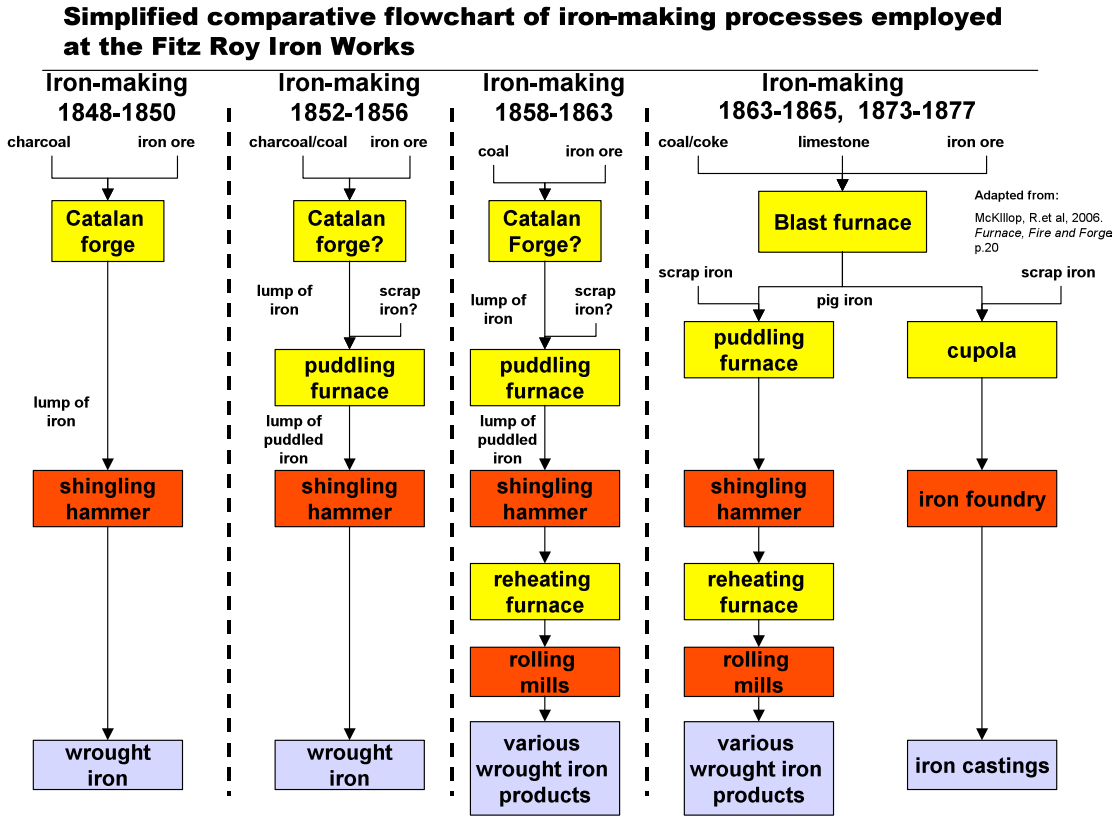

Figure 3: Flowchart of iron-making processes at Fitz Roy showing the increase in complexity of operations with increasing investment.

The plant described by the Sydney Morning Herald was the centre of an integrated iron-making enterprise including coal mines connected to the works by a tramway, quarries, a brickworks and a newly constructed blast furnace to smelt iron ore and foundry. [43]

Lattin's investments appear to represent a zenith in the development of the iron works. Subsequently the Fitz Roy Iron Works Company Incorporated and Fitzroy Bessemer Steel Hematite Iron and Coal Company (Limited) undertook improvements to enhance the efficiency of the blast furnace and other plant. The foundations of the apparently poorly bedded rolling mills were reconstructed a number of times between 1865 and 1877. It is possible that William Sandford also partly reconstructed the rolling mill footings in 1886.

1.3 Building Settlements, Towns and Cities –

[40] Johnson-Liik, E., Liik, G. & Ward, R., 1998. *A Measure of Greatness*. p.7
[41] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.20
[42] Johnson-Liik, E., Liik, G. & Ward, R., 1998. *A Measure of Greatness*. p.18
[43] Else-Mitchell, R., 1981. *Early Industries in the Mittagong District*. pp.16-17

Towns, Suburbs and Villages

The Fitz Roy Iron Works was the catalyst for the creation of the town of Mittagong. The first employees of the 1848 iron works lived in tents while the village of Nattai was established. Houses for workers had been constructed by 1852.[44] The recorded employment of up 70 men at the works in 1863 must have created additional demand for housing. This and ongoing difficulties in raising capital led directors to release land for sale in 1865. Lots sold from £125 to £10 at a time when workmen's wages were 10 shillings a day.[45]

Ebenezer Vickery, Simon Zollner and other directors of the Fitz Roy Iron Works Company had planned the creation of a model township at a meeting on 26 August 1864. The name 'New Sheffield' was adopted at this meeting which planned a town comprising quarter-acre lots set around a one-acre lot set aside for a Wesleyan church. The town was laid out with streets 20 metres wide and lanes of 10 metres width.

> *This created a townscape very different from most country towns and strikingly different from (the nearby government town of) Welby or from the later much closer subdivision of Nattai between the Great South Road and the railway. The ironworks played, therefore, a critically important role in producing Mittagong's rather strange urban design*.[46]

The uncertain future of the ironworks influenced the development of this area and few permanent houses were built within the town[47]. Following the failure of the Fitzroy Iron Works Company in 1869 director Ebenezer Vickery 'and a number of his colleagues retained an interest in Mittagong'[48], including ownership of large sections of New Sheffield.

Vickery was a founding director of the Mittagong Land Company Ltd, which was floated in December 1883. This company undertook further subdivisions that extended the original New Sheffield holdings. They retained some land that was deemed to be of commercial value.[49]

By its presence the ironworks had some influence on the course of the Great Southern Railway and ensured that a railway station was built at Mittagong in 1867.[50] The works also drew people to Mittagong for employment and trade. The development of worker housing and subsequent subdivisions of ironworks land had a major influence on the progress and current layout of the town of Mittagong.

1.4 Marking the Phases of Life – Persons

The Fitz Roy Iron Works has associations with a range of leading colonial businessmen and would-be entrepreneurs. Perhaps its most famous associations were with men who would later become key players in the development of Australia's iron and steel industry. The most celebrated of these is William Sandford who leased the works in 1886. Enoch Hughes, who had a number of associations with Fitzroy, is also considered a key player in the development of the iron-making industry in the nineteenth century.

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[44] Day, L., 2006. A Selective History of the Fitz Roy Iron Works.
[45] Day, L., 2006. A Selective History of the Fitz Roy Iron Works.
[46] Jack, I. & Cremin, A., 1994. *Australia's Age of Iron*. p.26
[47] Jack, I. & Cremin, A., 1994. *Australia's Age of Iron*. p.26
[48] Jack, I. & Cremin, A., 1994. *Australia's Age of Iron*. p.25
[49] Godden Mackay Logan, 2005, Mittagong Marketplace – Archaeological Assessment and Research Design. p.12
[50] Lee, R., 1988. *The Greatest Public Work*. P.161

Other persons associated with Fitzroy contributed to the development of the iron and steel industry. Edward G. Larkin, who leased the Fitzroy works in partnership in 1877 was appointed by William Sandford as supervising engineer at Fitzroy in 1886. Larkin moved with Sandford to Eskbank and remained in his employ until 1891.[51]

Enoch Hughes was born in Dudley, Staffordshire. After leaving school at the age of 14 he obtained employment at various Black Country ironworks. He emigrated to Australia at the end of 1857, arriving in Melbourne on 1 January 1858. Described as 'confident in his abilities and an accomplished self-promoter'[52] he quickly established the Victoria Rolling Mills in West Melbourne in partnership with pawnbroker Benjamin Marks. The business seems to have failed and was sold in 1861. In 1862 Hughes was trading as an "iron hurdle maker and smith" in Bourke Street, Melbourne.[53]

He was at the Fitz Roy Iron Works in October 1862 'where he succeeded in smelting pig iron from the company's ore in a cupola furnace using coal obtained on the company's land. He formed a partnership with Benjamin Lattin to develop the Fitzroy works and was responsible for the construction of the Fitzroy blast furnace. His design, based on an antiquated 1830s model, proved to be inefficient and the furnace had to be heavily modified before it was capable of producing large quantities of pig iron. Hughes and Lattin had parted company on less than amicable terms by 1864.[54]

Hughes returned to Fitzroy with his brother in 1867 to make wrought iron products in a brief and unsuccessful venture[55]. He went on to become a promoter of iron-making ventures in Victoria and New South Wales and was one of the founding partners of the Lithgow Valley Iron Company which was established in 1874[56]. He was responsible for the construction of the company's first blast furnace, which bore a remarkable resemblance to the earlier Fitzroy furnace[57]. Although not associated with particularly successful chapters in the saga of iron-making in New South Wales Hughes is remembered as a person of vision who encouraged the development of new ventures.

William Sandford is rightly regarded as the father of the Australian steel industry. Born at Torrington, Devon in 1841 he worked for the Great Western Railway Company and subsequently at iron works in Bristol, Middlesbrough and Hartlepool. He came to New South Wales in 1883 to establish the colony's first wire netting manufacturing plant on behalf of John Lysaght Ltd. He subsequently established his own business and received a five-year government contract to roll rails. He leased the Fitz Roy Iron Works in 1886 to fulfil this contract but found the plant inadequate and subsequently moved his operation to the Eskbank Iron Works in Lithgow[58]. It was in Lithgow where Sandford pursued his vision to make steel from local ores. On 24 April 1900 he produced the first commercial steel made in New South Wales[59] and by 1907 he had developed the first integrated steelworks in Australia.

[51] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.81
[52] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.15
[53] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.15
[54] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.16
[55] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.17
[56] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.37
[57] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. pp.39-41
[58] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.81
[59] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.99

Associations with Fitz Roy were not limited to persons influential in the further development of the Australian iron and steel industry. Colonial entrepreneurs such as Frederick Rothery, Ebenezer Vickery and Simon Zollner were active participants in the development of different phases of the works.

Rothery was chairman of the Fitz Roy Iron and Coal Mining Company from 1854 (refer to **Section 1.1**). He was the brother-in-law of Thomas Icely of Coombing Park, Carcoar[60]. Coombing Park was a source of iron ore for the Eskbank Iron Works.

Ebenezer Vickery was ' a very successful investor and entrepreneur both in Sydney and rural New South Wales. He was born in London in 1827, the son of Joseph Vickery, a boot and shoe manufacturer. He migrated to New South Wales with his family in 1833, was educated in Sydney and later apprenticed to T. Bowden, an ironmonger.[61] In 1851, at the age of 24, he had taken over 'his father's boot factory in George Street, Sydney … while his father concentrated on acquiring country properties'[62]. He 'acquired premises in Pitt Street in 1860 and reconstructed them as Vickery's Chambers'. This building, constructed with a frame of iron girders manufactured at Fitz Roy, was the first of its kind in Australia.[63]

Following the failure of Fitz Roy Vickery expanded his business interests, building a large commercial empire 'by hard work and sound business acumen'[64]. He held interests in shipping and coal mining. His mining interests included the South Greta Coal Co., Mount Kembla Coal and Oil Co. and Coal Cliff Coal Co. Vickery also became a director of a number of financial institutions and in 1887 was elected to the New South Wales Legislative Assembly.[65]

Vickery was 'a staunch Methodist' and a great supporter of tent missions. In 1905 he purchased the Lyceum Theatre in Pitt Street, spent £27,000 on alterations and gave it to the Methodist Church. He was a founder of the Young Men's Christian Association, supporter of the Young Women's Christian Association and a benefactor to 'Sydney public charitable institutions.[66]

Simon Zollner was born in Prussia in 1821. He emigrated to Australia from Hamburg in 1852 and by 1853 was trading as a merchant at Sofala. In partnership with others Zollner established a tinplating works in George Street, Sydney. By 1860 he was sole owner of the business and had introduced a galvanising plant. During the 1860s the works were relocated to larger factory in Dixon Street and a warehouse was established in York Street[67]. By 1870 Zollner's:

> *Sydney Galvanizing Works employed up to fifty-two men and boys and worked up fifteen to eighteen tons of black sheet-iron a week into galvanized tubs, buckets, tanks, sheep troughs, guttering and ridging in addition to tinware products, including cans, pannikins, candlesticks, candle moulds, pitchers and teapots.*[68]

[60] Icely, Thomas (1797-1874) [Online]
[61] Vickery, Ebenezer (1827-1906) [Online]
[62] Jack, I. & Cremin, A., 1994. *Australia's Age of Iron*. p.19
[63] Jack, I. & Cremin, A., 1994. *Australia's Age of Iron*. p.19
[64] Vickery, Ebenezer (1827-1906) [Online]
[65] Vickery, Ebenezer (1827-1906) [Online]
[66] Vickery, Ebenezer (1827-1906) [Online]
[67] Zollner, Simon (1821-1880) [Online]
[68] Zollner, Simon (1821-1880) [Online]

Vickery and Zollner were both connected with the 'Hardware Association, a cartel that controlled the Sydney iron trade'[69]. This group had ongoing influence over the direction of ironmaking in New South Wales during the 19th century.

Other figures involved at Fitz Roy were also to play a role in the development of the iron and steel industry. In addition to William Sandford and Enoch Hughes William Miller, Daniel Harris and Thomas Bladen were later involved in the development of the Esk Bank Ironworks in Lithgow[70].

[69] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.17
[70] McKillop, B. et al, 2006. *Furnace, Fire and Forge*. p.23

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