Timber-getting in the Forest: an archaeological case study of six nineteenth century sawpit sites

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Thesis submitted as partial fulfilment of a Bachelor of Arts with Honours in Archaeology at the University of Western Australia,

3rd June 2005
This research would have been impossible without the assistance of a number of people. Firstly I must thank the love of my life, my wife Fiona, for her tremendous support throughout this arduous process. Without her I couldn’t possibly have completed this research. Secondly, I need to thank my Mum Lynda, for her tremendous financial support throughout my second stint at uni, culminating in this honours research. Third, I would like to thank my supervisor Dr. Alistair Paterson, for his advice and support. He has always been available to help, and has kept me going when I felt like quitting. His advice has been invaluable and he has kept me focussed on the important things. Many others have contributed to this thesis. In no particular order I would like to thank Dr. Shane Burke for his advice, Andrew Hannah and Peter Sewell for being understanding bosses, Kelly, Karen, Felix, Joanne, Kevin, Ruth and Nathan for helping me with my fieldwork, Jamie and Craig for help with maps and diagrams, the Department of Conservation and Land Management, the Water Corporation, and the Shire of Kalamunda, for giving me access to their land to carry out fieldwork, and the good people at the Kalamunda Historical Society, Kalamunda Library, State Records Office, and Battye Library for their general help. And last, but certainly not least my family and friends, who have barely seen me for six months, put up with me being cranky and preoccupied, cancelling stuff because I was writing, and just generally because of their tolerance.
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Abstract

This research was an archaeological investigation of the technology and organisation of the early timber industry and the social life of timber workers in the Darling Scarp of Western Australia. During January and February 2005, six sawpit sites in an area known as the Canning Timber Concession were investigated using surface survey. Survey at these sites was hampered by heavy vegetation limiting ground visibility. Artefactual assemblages were recorded, however the main archaeological information recovered related to the sawpit features at each site. Analysis of archaeological data determined that sawpits were not evenly distributed in the forest, and that their placement was directly related to the location of very large individual trees. Traditional sawpit technology was seen to have been adapted by timber workers to deal with the difficulty of digging in the hard ground of the Darling Scarp. Insufficient evidence was recorded to determine the timing of the use of sawpits in the Canning Timber Concession. Historical documents suggested that timber workers lived at sawpit sites and while no evidence for this was recorded, analysis of artefacts suggested domestic activities were occurring at sawpit sites.
Chapter One - Introduction

This research is a study of the archaeology and history of the early timber industry of the Darling Scarp in Western Australia, during the second half of the 19th century. Archaeological data was used in conjunction with available historical sources to investigate the jarrah timber industry in the southern localities of the Shire of Kalamunda. Seven archaeological sites were investigated (figure one); all were located in an area designated by the Surveyor General in 1871 as the ‘Canning Timber Concession’. An investigation of sawpits, the primary technology used to exploit timber, forms the basis of this study. There are few historical records that document either this technology or the people who used it, and there has been very limited archaeological study of sawpits. Sawpit sites were investigated using field survey, and technological aspects of sawpits, and domestic remains at each site were recorded. This evidence was then analysed to provide insight into the technological processes involved in timber-getting and the domestic life of the people who worked in this industry.

The themes of isolation, integration (Davies 2001a) and adaptation (Vines 1985) are used to organise the investigation of sawpit sites. These themes will be discussed in detail in chapter two, but I will briefly introduce them here. Previous archaeological research into the archaeology of the Australian timber industry by Vines (1985), Davies (1999, 2001a, 2001b, 2002) and Smith (2003) have shown that the practice of timber-getting in the forest isolated timber workers from
Figure one A. Location of Canning Timber Concession (map taken from Australian Natural Resource Atlas 2005).

Figure one B. Location of sites within the Canning Timber Concession (map taken from Western Australian Atlas 2002).
society requiring them to develop innovative strategies for survival. This isolation forced timber workers to adapt the way they lived and the technology they used. Their material culture reflects this, demonstrating the reuse and recycling of many tools and materials, and the adaptation of timber-getting technology. Despite this isolation, Davies (1999, 2001a, 2001b, 2002) has shown that timber workers were still integrated into the wider society, demonstrated by a transfer of luxury goods to the isolated timber settlements, which is again reflected in the material culture remains at timber sites. The themes of isolation and integration were developed by Davies, and the theme of adaptation by Vines, during their research into sawmill and habitation sites. I used these three themes to develop strategies for investigating the sawpit sites of the Canning Timber Concession. Field methods were developed to test for evidence that isolation, integration and adaptation impacted on timber workers.

**Significance of research**

Timber-getting was an important colonial industry in Australia, New Zealand and North America. Colonists arriving in these places recognised the potential of timber for industry and moved immediately to exploit this resource. I was thus surprised to find that there has only been very limited archaeological investigation of this industry worldwide. Industrial and historical archaeology seems to have ignored timber-getting in favour of other more accessible industries. This research is significant because it contributes to our knowledge of an industry of which little is known and because it determines the organisation of
that industry, technological responses to new environments and timber types, and the response of timber workers to external forces such as isolation.

In Australia archaeological remains of the timber industry have been defined as either *primary*, directly related to resource exploitation in the forest or *secondary*, related to timber processing (Flood 1979: 32; Vines 1985: 157). Under this definition, sawpit sites within the forest are primary timber industry sites. Past archaeological investigation has concentrated on processing sites, such as timber settlements and sawmills. Davies suggests that timber settlements are typically isolated outposts in the forest where people lived, where they built houses, schools, sawmills (2001a: 1). However, these settlements only represent part of the timber industry. They cannot exist without the activities of timber-getters in the forest cutting and processing timber. This study aims to redress this imbalance by looking at one archaeological aspect of the primary timber industry.

During my research I have found that there is very limited documentary evidence relating to the early timber industry in Western Australia. An examination of this industry, such as that by Thomas (1929) or Robertson (1956) shows that it was run by private companies, labour was provided by a largely illiterate workforce and government record keeping at the time was limited. The records that do exist, such as newspaper reports, journals, and police and convict records, tell us little about the primary aspects of the industry and the people who worked in it. Historical studies of the industry have tended to be either biographical or
economic (eg Thomas 1929; Robertson 1956; Dolin 1969). Both historical sources and scholarship are silent on the process of timber-getting, and the people who carried out the work. Thus, archaeology can potentially examine areas that historical scholarship cannot.

This research is also significant because it allows us to see the consequences of a global industrialisation that was occurring throughout the 18th and 19th century as part of the Industrial Revolution. The European colonial diasporas carried European ideologies and technologies to the colonies (Orser and Fagan 1995: 11). British colonists arrived in Western Australia with ideas and practices that informed the way they lived and how their colony should develop. Orser and Fagan suggest that this colonisation had global consequences with colonists becoming part of a physical network of towns and countries, and an ideological network involving the transfer of European ideals that spanned the entire world (1995: 11-12). Thus, the British colonists in Western Australia were part of the physical and ideological network of the British Empire.

Amongst the motives for British colonialism were industrialisation, capitalism and trade. Connah suggests that, after feeding themselves, the next most urgent task for colonial settlers was to produce exportable goods that would provide them with capital and the ability to trade within the wider colonial world market (1988: 84). Birmingham and Jeans suggest that the colonisation of Australia was part of a move “…to recreate a complete industrial civilisation in the colonies” (1983: 7).
The colonisation of Western Australia was part of a movement to extend the industrial sphere beyond Britain, to exploit new resources and to recreate the conditions of home in new places. Thus, the settlement of Australia was “…an expression of the consequences of the Industrial Revolution, and industry is bound up with every part of the tale” (Birmingham et al 1979: 7, authors italics).

Industrialisation in Western Australia was limited during the first 50 years of the colony’s existence, hampered by a lack of infrastructure, labour and capital (Calder 1980: 8). Until the discovery of gold in the late 1880s, the colony relied on meagre exports of wool, timber, mining, sandalwood and whale products (Linge 1979: 707). Industrial exploitation of hardwood timber, sandalwood, whale products and metals was small in scale and often remote from the main habitation centres of the colony.

This research is significant because the study of small local industrial sites such as sawpits, allows the investigation of industrialisation in Western Australia. While industrialisation was a worldwide process, it developed as individual industries in individual locations. Global industrialisation was a process of which local industry was the expression. This research then, potentially allows us to measure industrialisation on three levels, as the development of local industry, as part of the industrialisation of the Swan River Colony, and as part of a global industrial movement.
**Research aims**

The main aims of this research were developed in response to previous research and information recovered from a survey of historical documents. My general aim was to investigate the way sawpits were constructed and used within the forest. More specifically, I aimed to test for evidence of adaptation by timber workers to isolation within and to the new environment of the jarrah forest.

Historical documents suggest that timber workers in the forest based their lives around sawpit sites. They suggest that sawpits were not simply used for their primary industrial purpose, but that timber workers and their families also lived in the forest at these sites. These documents however, provide no detail about the life of timber workers in the forest. My research aimed to test for evidence of habitation at sawpit sites, and if found, the nature of this habitation. Based on the work of Vines (1985), Davies (1999, 2001a, 2001b, 2002) and Smith (2003), I expected that if isolation was a factor for timber workers in the Canning Timber Concession, evidence such as the reuse and recycling of material culture would be seen.

Vines’ suggests that timber-getting technology is forced to change and adapt to new environments and timber types (1985: 29). The Swan River colonists used the expedient technology of pit-sawing to exploit hardwood timber resources. Based on Vines’ (1985) work my research aimed to test for the adaptation of sawpit technology to the environment of the Darling Scarp and the new timber of
jarrah. If seen, this adaptation was to be analysed to determine how timber-workers adapted to this new environment.

The limited documentary record does not record details of the organisation and timing of the timber industry in the Canning Timber Concession. My research aimed to examine this organisation of the industry through an investigation of the frequency and distribution of sawpits in the forest. I aimed to determine what factors influenced sawpit placement in the forest, whether placement was entirely dependent on the location of timber resources, or if other factors were involved.

A final aim of this research was to test a sample of sawpit sites to allow further studies to be more informed of their archaeological potential. Connah states that archaeological evidence of the primary timber industry within the forest is “…unlikely to have left many traces that can be identified” (1988: 140). Sawpits are one of the few site types within the forest representative of the primary timber industry. However, they have never been archaeologically investigated before in this way, and evidence associated with them may be too limited to make any real interpretation possible. Thus, the validity of investigating these sites will be determined.

*History of the Canning Timber Concession*

It is necessary to consider a broad history of the Canning Timber Concession. The exploitation of timber resources in Western Australia began in 1829 with the
commencement of the Swan River Colony, but it was not until the 1860s that a viable export hardwood timber industry developed (Linge 1979: 707). The first attempt at developing a timber industry in the Darling Scarp to the east of the Swan River Colony, was made by Benjamin Mason sometime around the late 1850s to the early 1860s (Robertson 1956: 6-10). Primarily using convict labour, probably in the form of ticket of leave men (Slee and Shaw, 1979: 8; Thomas 1929: 38) Mason was responsible for the development of a company which cut jarrah timber for local industry and for export. This company set up a small sawmill and settlement at Mason’s Mill in Carmel in 1864 (Slee and Shaw 1979: 7). Mason set up a steam powered sawmill at Carmel by 1868 (Slee and Shaw 1979: 14-15). However, Slee and Shaw suggest that the advent of mechanical sawing at the Canning Concession did not mean an end to pit-sawing and both methods were used in tandem (1979: 15). The government granted Mason a series of permits to log timber throughout the 1860s, until he was finally granted the right in 1870 to exploit timber in the Canning Timber Concession, a 129,310 acre (52,330 ha) area south of the Helena River (Mason and Barlee, 1870).

Mason’s right to exploit the Canning Timber Concession was not exclusive and his company had to compete with private sawyers for timber in the area (Robertson 1956: 10). Due to transport problems, Mason’s company went bankrupt in 1882 and after this only private sawyers exploited the timber in the area until Edward Keane took over the Canning Timber Concession in 1891 (Slee and Shaw 1979: 44). Historical documents suggest that Keane gained
exclusive rights to log the Canning Timber Concession and that private sawyers were now excluded from the area (Slee and Shaw 1979: 44-45). Keane introduced new technologies in the form of a railway, traction engines and a larger sawmill at Canning Mills (Slee and Shaw 1979: 46-48). These should have made the sawpit obsolete but it is unknown when pit-sawing ceased in the Canning Timber Concession. By examining the archaeological remains, this research will test for evidence of the duration of sawpit use and if so, whether pit-sawing ended with the arrival of Keane or if it continued into the 20th century.

**Structure of the thesis**

This thesis is broken into seven chapters. This chapter has provided a background to the research. Chapter two examines relevant previous archaeological studies. Chapter three examines relevant primary documentary sources and historical scholarship. Archaeological and historical sources are used to develop hypotheses that can be tested during fieldwork. Chapter four outlines the methods used during fieldwork and theory related to the development of these methods. Chapter five outlines the archaeological results recovered during fieldwork and later analysis. Chapter six discusses these results and determines whether the aims of this research have been achieved. Chapter seven concludes the thesis with a review of methods used and suggestions for further research.
Chapter Two – Review of archaeological literature

In this chapter I examine archaeological literature relevant to my research. Despite the importance of colonial timber exploitation in Australia, New Zealand and North America, published archaeological research relating to timber industries are scarce. As a result my research relied on a small number of sources to develop a theoretical framework. The themes of isolation, integration and adaptation, based on the work of Vines (1985), Davies (1999, 2001a, 2001b, 2002) and Smith (2003) were used to situate my research. In addition, I reviewed literature relating to other extractive industries where these themes may also have been relevant, such as mining and whaling. I hoped that information from these industries could be used analogically in my research.

The review recovered few sources relevant to my research and almost all of these came from Australia. Historical archaeology is practiced around the world and one of its major concerns is to investigate “European expansion and colonialism… and the economic and political forms which were generated, in particular the spread of capitalism” (Paulo et al 1999: 2). Colonial timber industries worldwide are thus relevant to my research. However Vines, in his honours thesis written in 1985 discusses “…the general neglect or ignorance of the (timber) industry in the historical and archaeological literature” (1985: 13). Since 1985 there have been few published papers which investigate the archaeology of colonial timber industries.
In Australia, an examination of the Index of Volumes 1 – 19 (1983 – 2001) (Connah 2002) of Australasian Historical Archaeology, demonstrates this. Within this index there are no papers relating directly to the archaeology of the timber industry and indeed, few which relate to it even peripherally. In comparison there are ten papers directly related to mining. Similar reviews of major international journals such as Historical Archaeology and Industrial Archaeology find few papers with any direct relation to the timber industry. However, there are some Australian sources that are of use. These include one doctoral thesis by Davies (2001a), two honours theses by Vines (1985) and Smith (2003) and papers by Gaughwin (1992) and Connah (1996) which provide some relevant information.

A survey of published literature from New Zealand, where timber exploitation was an important early industry, provides no relevant archaeology. Fleet, in her history of the New Zealand timber industry, mentions the extensive use of pit-sawing for timber processing, suggesting that as late as 1850, “…the production of pitsawn timber exceeded that of the mills” (1984: 61). Given that the exploitation of timber commenced around 1800 (Fleet 1984: 25) but that the first mechanical mill was not established until 1835 (Fleet 1984: 38) there should be significant archaeological sawpit remains. Yet both Mahoney (1983), and Hayward and Diamond (1983) fail to mention sawpits in their reviews of archaeological evidence for the timber industry. Smith (1990) followed this with a review of the literature relating to historical archaeology in New Zealand. There were limited sources relating to the timber industry and those that exist
concentrate on secondary aspects. A review of the *New Zealand Journal of Archaeology* since 1990 also fails to find any reports related to the timber industry.

The situation is similar for the United States. There is a considerable body of historical scholarship (eg Carroll 1973; Lower 1973; Wynn 1981; Maxwell and Baker 1983) on the development of the timber industry, as timber exportation was extremely important to the development of North American economies. But a review of the relevant North American archaeological journals, such as *Historical Archaeology*, fails to uncover much archaeology related to the timber industry.

The archaeological literature from Europe contains little information of use. For the British Isles, where the secondary timber industry was of necessity small and based on timber importation (Carroll 1973: 18-21), this is not surprising. The archaeological literature from continental Europe contains some research relating to the timber industry, but frustratingly, none is in English. The archaeological sources relating to the timber industry are thus limited and Australian archaeology seems to have the greatest amount of relevant information.

**Relevant archaeological research**

Australian archaeological research into the timber industry has largely concentrated on sawmill sites and timber settlements. Both Flood (1979) and Vines (1985) make a distinction between the primary and processing aspects of
the timber industry (table one). They define archaeological resources such as felling sites, saw-pits, and forest camps as primary timber extraction sites, while sawmills and timber settlements are classed as secondary timber processing sites (Flood 1979: 32; Vines 1985: 157).

<table>
<thead>
<tr>
<th>Primary timber industry sites</th>
<th>Timber processing sites</th>
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</thead>
<tbody>
<tr>
<td>sawpits</td>
<td>sawmills</td>
</tr>
<tr>
<td>felling sites</td>
<td>timber settlements</td>
</tr>
<tr>
<td>forest camps</td>
<td>timber yards</td>
</tr>
<tr>
<td>logging tracks</td>
<td>plywood factories</td>
</tr>
<tr>
<td>tramways</td>
<td></td>
</tr>
</tbody>
</table>

Table one. Primary and processing timber industry sites, based on Flood (1979: 32) and Vines (1985: 157)

The distinction is important because the primary industry largely occurred in a widespread fashion throughout the forest itself, while processing was confined to limited and well defined areas such as sawmills. Roles within the industry were also defined by this dichotomy. Primary industry workers, including fallers, sawyers, hewers and teamsters, worked in the forest, while processing was carried out by sawmillers and blacksmiths at the sawmill sites (Slee and Shaw 1979: 7-14).

Almost all previous archaeological investigation of the Australian timber industry has concentrated on processing sites. There is virtually no published archaeological work on the primary aspects of the timber industry, including sawpit sites. Despite this, previous work has provided important information about the lives of timber workers and the technology they used. The similarities
between the primary and processing aspects of the industry mean that findings from this previous work can be used to develop a theoretical basis for my research.

Three works in particular by Davies (1999; 2001a; 2001b; 2002), Vines (1985) and Smith (2003), provided data that I used to develop hypotheses for my research. I will discuss the important elements of all three and then discuss how their findings are pertinent to my research. Davies (1999; 2001a; 2001b; 2002) investigated Henry’s Mill in the Otway ranges of Victoria. His research, examined the “…social and material lives of these men, women and children” (Davies 2001a: 1) who lived and worked at Henry’s Mill. He concentrated on the material culture of the mill, in a holistic study aiming to learn about people with little written history, and explored “…the ways people adapted to living in an isolated forest area” (Davies 2002a: 8). Davies concentrated primarily on the houses of people living at the mill site, rather than the mill itself. While technology is discussed, he is primarily concerned with the lives of the mill workers.

A major theme of Davies’ work is isolation. He describes Henry’s Mill as being “…ten kilometres south of the nearest township” (Davies 1999: 250), and as such, isolated from the wider society. There was only one way to leave the mill site, via a tramway and trek through terrain where three miles an hour on horseback was considered a good speed (Davies 2002: 64). Commuting from larger centres to the mill site on a daily basis was impractical and as such a small
community of timber workers and their families developed. The mill’s isolation required its inhabitants to develop a level of self sufficiency. More than timber processing occurred with a school, a store, a butcher, and bakers all resident at the site (Davies 1999: 250). Mill inhabitants were forced to rely on themselves, and Davies suggests that both teachers and doctors were reluctant to travel to, or live at the site (2002: 64).

This isolation is reflected in the mill site's material culture, which demonstrates that residents of the mill “…adopted a practical and thrifty approach to dealing with their environment, utilising materials available locally and naturally whenever possible, and expediently adapting manufactured materials into domestic structures” (Davies 1999: 258). There was little importation of building materials and most structures were built from local wood. Artefactual evidence suggests that residents reused and adapted items to different uses as required. For example “… bottles were cut down to form storage jars…. while empty kerosene tins were recycled into buckets and wash troughs” (Davies 2001b: 45). Food stuffs were largely produced locally with vegetables grown in gardens, while rabbits and fish were caught to supplement mutton (Davies 2001b: 45). The inhabitants of the mill site were forced to be innovative in the way they dealt with their material culture, as their isolation made the replacement of items difficult.

The other major theme of Davies’ work is that timber workers were integrated into larger trade and social networks extending beyond the mill site. Numerous
material culture items including alcohol, sauce and soft drink bottles, tinned goods, ceramic tablewares, and in particular, patent medicine containers were all regularly brought into the mill site (Davies 2001b: 45). Imported goods from the United Kingdom, United States, Europe, Japan and other parts of the world were brought into the mill (Davies 2002: 64-65). Despite the isolation of the site, there was still regular contact with the outside world. This dichotomy of isolation and integration forms the bulk of Davies’ work; mill workers were forced to adapt to isolated circumstances but were still connected with a wider social and economic world.

These themes of isolation and integration are mirrored in Vines’ (1985) research, which examined the technology of sawmilling in Victoria. In contrast to Davies, Vines focused on technology and virtually ignored the social and material lives of mill workers. Vines’ aims were to record sawmill sites to examine “… spatial and temporal variability and change” (1985: 18) in the technology and economics of sawmilling in Victoria. He did this through a survey of 25 Victorian forest sawmill sites.

Vines suggests that isolated conditions within forests forced the local improvisation and adaptation of sawmilling technology (1985:147-149). He describes forest mill sites as “…isolated and temporary settlements deep in the bush, often miles from permanent settlement or all weather roads” (Vines 1985: 12). Consequently, he suggests that local materials (mainly timber) were
primarily used in the construction of mills and only the essential sawmill machinery was imported (Vines 1985: 147-149). Second hand materials were regularly utilised and there was a large degree of improvisation in the use and reuse of mill technology (Vines 1985: 152). In particular, Vines suggests that local environmental conditions and timber types caused local adaptations of existing timber processing technology (1985: 29).

Despite this, Vines suggests that there was a tendency towards archaism, “…where outdated methods and equipment remained in use long after they had become obsolete” (1985: 159). He suggests that mill owners retained old technology and reused old equipment in order to keep costs down (Vines 1985: 159). Thus, local adaptation was tempered by the conservation and reuse of materials and economic constraints restricted further technological development beyond a certain point. Once an appropriate technology level was reached it remained until a greater processing output was required.

The third specific archaeological study of the timber industry was conducted by Smith (2003), who studied the spatial layout of Jarrahdene Mill and Dean Mill in the south-west of Western Australia. She aimed to show how the ideology of mill owners was expressed in the layout of mills, and how this layout was used as a factor for maintaining class and status differences (Smith 2003: 6). Like Vines (1985) and Davies (2002a), Smith found that material culture was reused and recycled at Jarrahdene Mill, but not at Dean Mill (2003: 61). The differences
between the mills were both geographic and temporal. The earlier mill, Jarrahdene, which dated to the 1890s, was isolated deep in the forest. In contrast, Dean Mill which dated to the early 20th century was situated close to a town and railway line. Smith’s findings thus reinforce the concept of isolation as a shaping factor for the study of the timber industry.

Davies’ (1999; 2001a; 2001b; 2002), Vines’ (1985) and Smith’s (2003) findings can be used to provide a theoretical basis for study of the primary timber industry of the Canning Timber Concession. Three points are particularly pertinent. First, geographic isolation within the forest was seen in all three studies to lead to the re-use and recycling of material culture and the innovative adaptation of local materials by timber workers. This occurred with both domestic and industrial items. The case study of sawpits will test for the effect of isolation at primary timber industry sites in the Canning Concession. The six sawpit sites were used in what was then, isolated and remote forest. Between 1862 and 1889, the only recorded settlement in the area was Mason’s Mill, which was 14km from the nearest settlement at Cannington (Slee and Shaw 1979: 8). The six sawpit sites were between two and six kilometres away from Mason’s Mill. Isolation can therefore be expected to be a factor in the archaeology of both domestic and industrial material culture at these sawpit sites.

The second point based on Vines’ (1985) work relates to the technology of pit-sawing. Vines states that new forest environments forced timber workers to
adapt existing technologies to local conditions (1985: 29). A case study of sawpit sites allows us to test this for the primary timber industry. A new timber type, in the form of jarrah and a new environment in the form of the jarrah forest, would precipitate the adaptation of sawpit technology.

The third point relates to the concept of archaism in timber processing technology caused by limited capital (Vines 1985: 159). Pit-sawing technology was retained in the Canning Timber Concession for a considerable time after the introduction of mechanical sawmilling technology. In 1868 Mason negotiated a contract to provide railway sleepers to India. This provided an immediate increase in capital, which Mason used to import steam powered mechanical sawmilling equipment which was set up at Mason’s Mill (Slee and Shaw 1979: 14). There were insufficient funds however to improve the transport of sawlogs within the forest and as “…the greatest distance horses or bullocks could drag a sawlog was 3.2km,” (Slee and Shaw 1979: 8), sawpits were still required to break down large jarrah trees for transport to Mason’s Mill. Mason never gained the capital to develop an effective transport system, nor to upgrade his sawmilling equipment. In 1891, when E.V.H. Keane gained exclusive access to the Canning Timber Concession, he injected considerable funds to develop better transport and sawmilling options and exclude private sawyers from the area (Slee and Shaw 1979: 48). This increase in capital should have meant the end of pit-sawing in the Canning Timber Concession. My survey of sawpit sites will test for the
timing of sawpit use and thus measure the effect of archaism in the Canning Timber Concession.

Connah’s (1996) study of Bagot’s Mill in the New England region of New South Wales also demonstrates technological archaism in the timber industry. This study is primarily an investigation of a failed mill, at which a water-wheel was used to power a flourmill and sawmill. It concentrates on the reasons for the mill’s failure, its abandonment and later re-use in various ways (Connah 1996). During his excavation of the mill site, Connah uncovered a sawpit which he describes as well constructed with the “…stonework of its sides… carefully laid with lime mortar” (1996: 33). The saw-pit is interpreted as being used to reduce large logs to a size that could be cut in the sawmill itself. The careful construction indicates regular use in the sawmilling process; as Connah says, “…the unexpected anomaly: a sawpit for hand-sawing at a power-driven sawmill” (1996: 33). This indicates that, as with the Canning Timber Concession, the adoption of powered sawmilling technology did not immediately make the saw-pit obsolete. Instead, this archaic technology was still required to deal with large logs. Connah quotes oral sources which claim that this practice was still going on at certain mills in New South Wales in the 1930s (1996:33). At Bagot’s Mill, the saw-pit was directly associated with a functioning powered sawmill and comparison with sawpits in the Canning Timber Concession must be made with some caution. However the saw-pit at Bagot’s Mill provides one model for saw-pit construction, to which the Canning Timber Concession sawpits can be compared.
Gaughwin (1992) studied archaeological sites related to the timber industry, as part of a wider study of extractive primary industries in Tasmania. She concentrated on mining, but briefly discussed the timber industry. Two points relevant to my research can be drawn from her work. First, she discusses sawmills as the predominant type of timber processing site found in the forest (Gaughwin 1992: 61). Within her site inventory she lists 136 forest industry sites within a 16000 square kilometre area of north eastern Tasmania (Gaughwin 1992: 61). However only nine, or seven percent of all sites represent the primary timber industry. The remainder are all timber processing sites. Gaughwin suggests that this disparity is likely to be the result of site visibility within the forest (1992: 61). The implication is that visibility may potentially have an impact on my research. My research design needs to consider the effect of vegetation obscuring visibility, as all sites are located within the jarrah forest.

The second point drawn from Gaughwin’s work is her classification of tree stumps as a form of archaeological artefact (1992: 61). In a forest which has been logged more than once it may be difficult determine if tree stumps are related to sawpit sites. However, if an appropriate relation can be made dating of the stumps would be possible using dendrochronology. This would enable the date of site use to be determined. This is unfortunately beyond the scope of this research. However, a study of tree stump numbers and location in relation to sawpits may be able to provide relevant information.
Due to the lack of archaeological sources related to the timber industry, I surveyed the literature relating to other primary extractive industries in Australia. I hoped that information from these could be applied by analogy to the data I recovered during my field work. In particular I examined literature in which the primary industries were conducted in isolated circumstances. Published archaeological research into other colonial extractive industries such as whaling and mining proved mostly to be related to the industrial processes involved in those studies and were thus of little use to this study. Only one study of the lives of colonial gold miners in Victoria by Lawrence Cheney (1992, 1995) provided relevant information. Her study suggests similarities between the lives of timber workers and those of the gold miners. She suggests that gold mining was conducted by a largely transient population living in camps, which resulted in a short term occupation of sites, leaving ephemeral archaeological signatures (Lawrence Cheney 1992: 36). The transient nature of timber work, required timber workers to move locations as areas were logged out, which may result in a similar archaeological signature and may be able to be applied by analogy.

Lawrence Cheney suggests that the gold mining population in Victoria during the 19th century was largely transient, travelling from gold field to gold field in search of new gold strikes and maintaining a material culture collection of only what they could carry with them (1995: 21). This basic kit included only those items required for survival and mining at their next stop (Lawrence Cheney 1995: 175).
Between moves, miners would acquire luxury items such as ceramics, and use them while working at that location. These luxury items, which were redundant in terms of mining and survival, were then abandoned when the next move was required (Lawrence Cheney 1995: 174). Mining camp sites were thus only inhabited for short periods of time and archaeologically consist of artefact scatters of glass, metal and ceramic, being situated away from houses and other structures (Lawrence Cheney 1995: 128-129). The similarities between the transient lives of miners and those of timber workers may result in a similar archaeological signature at short term timber camps. The discard of luxury items at the sites investigated by Lawrence Cheney may be contrary to that suggested by “…the practical and thrifty approach” of timber workers (Davies 1999: 258). However, the archaeological signature of these sites may also provide an archaeological model which can be applied for short term timber camp sites.

The literature suggests one other relevant approach for my research. Connah (1983: 51) and Gibbs (2001: 65) both suggest that convict labour was used in the timber industry in Western Australia. Gibbs (2001: 61) classifies timber industry sites as convict sites and suggests they be investigated as such. Gibbs (2001) draws links between sites and convicts using historical records and there are a number of historical sources which provide evidence for the use of convict labour in the Canning Timber Concession. Thomas suggests that almost all of the sawyers working for Benjamin Mason were convicts (1929: 38), while Calder reports a team of convicts being allocated to work at Mason’s Mill in 1865 (1980:
However, no direct historical records exist that link the sawpit sites to convict labour. Additionally, the ephemeral nature of sites of this type makes it difficult to link them to convicts archaeologically (Gibbs 2001: 65). While there are clear historical links between convicts and the timber industry, it may be difficult to make the same links archaeologically for ephemeral sites such as sawpits.

**Conclusion**

In this chapter I have reviewed the archaeological literature relevant to my research. This literature has been used to develop a theoretical basis for my research. Sawpit sites have been defined as representing the primary timber industry. While I have found no literature relating to this primary industry, previous investigation of timber processing sites has been used to suggest approaches to my research. Consequently, I develop field methods in chapter four which test for evidence at sawpit sites of the effects of isolation and integration as suggested by Davies (1999; 2001a; 2001b; 2002), and adaptation and archaism as suggested by Vines (1985). Additionally, one archaeological model for sawpit construction (Connah 1996) and one archaeological model for short term campsites (Lawrence Cheney 1995) have been suggested by the literature. Finally, the literature has suggested that evidence of convictism (Gibbs 2001) may be present at sawpit sites in the Canning Timber Concession.
Chapter Three - Historical Sources

In this chapter I will examine the historical sources relevant to my research. I will discuss theory relating to the archaeological uses of documentary sources and review the available historical evidence, including primary documentary sources, secondary sources, and historical scholarship by both professional and amateur historians. These historical sources are used in conjunction with the information taken from the archaeological literature to develop hypotheses to be tested during fieldwork.

Using documentary sources in archaeology

Historical archaeology uses documentary and archaeological evidence to investigate the past. There have been numerous discussions over the way historical sources should be used with archaeology (eg Deetz 1988; Little 1994; Orser 1996). Feinman (1997) collates the substance of these discussions and gives a good overview of theory related to the use of documentary sources in archaeology. He suggests that in the past archaeologists have, when faced with conflicting documentary and archaeological data, given precedence to documentary evidence over archaeological evidence (Feinman 1997: 371-2). He also suggests that the two forms of evidence have been treated differently with a scientific approach to archaeological evidence and a historical approach to documentary evidence (Feinman 1997: 374). He argues that these approaches
lead to skewed results and instead advocates that both forms of evidence be
treated equally with scientific rigour (Feinman 1997: 374-5).

Both Wood (1990) and Stahl (1993) agree with this approach and argue for a
more rigorous criticism of documentary sources. Wood argues for a dual process
of external criticism, where the authenticity of a document is questioned, and
internal criticism, where the events described are questioned rather than simply
accepted at face value (1990: 85-92). Stahl agrees, referring to this as “source-
side” criticism, (1993: 247). This rigorous approach requires archaeologists to
take the time to evaluate historical sources for authenticity of source and
narrative.

My approach to documentary sources and historical literature will follow Feinman
(1997), Wood (1990) and Stahl (1993). I will approach historical and
archaeological data as sources of evidence which will be treated equally and
scrutinised critically. Historical evidence will be examined to determine its validity
as evidence. Archaeological and historical evidence will be used in a synthetic
process which sees both as being able to assist in meeting the aims of the
research.

*Primary documentary evidence*

There are limited documentary sources related to the early timber industry in
Western Australia relevant to my research. Vines (1985: 21) and Smith (2003: 6)
both remark on the lack of historical evidence directly relating to the timber industry. I conducted searches in the Battye Library, the State Records Office, The Kalamunda Library Local Heritage Room, the Kalamunda Historical Society Archive, and on the internet using online databases. I had extensive discussions with the librarians in the Battye Library and State Records Office and they suggested that records relating to the colonial timber industry are limited due to a largely illiterate workforce, and poor government record keeping at the time. There are few sources which describe timber-getting in the forest, industrial processes, or the sawyers themselves. Historical scholarship is also limited, as most investigation of the timber industry has either been biographical, about the people who ran the industry (eg Mills 1986), or economic, about the monetary costs and benefits of the industry (eg Dolin 1969).

I have also been unable to gain access to some documentary sources. Searches in the State Records Office and Battye Library failed to locate a roll map of a “Proposed Canning Tramway to Eastern Districts” dating to the early 1850’s, and the Records of the Canning Road Board, from 1867–1904. According to the State Record Office librarians, it is likely that these sources no longer exist.

There are some historical sources which are of direct use. Correspondence between Benjamin Mason and the Colonial Secretary Frederick Barlee (1870), discuss Mason’s application for a license to cut timber in the Darling Scarp area. Figure two shows the final page of a letter from Mason to Barlee requesting the
Figure two. Letter from Benjamin Mason to Frederick Barlee, with annotations by the Surveyor General, (1870, Kalamunda Library, WA)
reservation from sale of the area of the Canning Timber Concession. At the bottom of the page is a note forwarding the letter to the Surveyor General, who has duly added his own notation reserving “129,310 acres”. The Canning Timber Concession was defined by the Surveyor General as a specific area of land which, while not reserved for the exclusive use of Mason’s company, was reserved from sale to allow timber getting activities. Included with this letter is a sketch map, ostensibly in Mason’s hand, showing the area of the Canning Timber Concession (figure 3). There is no particular reason to doubt this source, as it is official correspondence between the colonial government and a businessman.

Descriptions of sawyer’s camps can be found in a number of historical sources. The first of these is *An Australian Parsonage, or, the settler and the savage in Western Australia* written by Janet Millett (1980) in 1872. This primary source describes life in the Swan River colony, written after Millet returned to Britain in 1869 (Erickson 1979: 587). It was therefore written a considerable time after Millet witnessed the events she describes. Her intent on writing the book was to “…provide a service to emigrants,” but one that does “…not pretend to the character of either a guide or a history of the colony. They are simply, as their name implies, sketches of the writers own experience” (Millet 1980: vi).

Millett describes a timber camp as consisting of a saw-pit and a rough hut (1980: 44-45). She describes the hut as resembling “…a letter V turned upside down,
Figure three. Sketch map of the Canning timber concession, by Benjamin Mason, (1870, Kalamunda Library WA)
…nothing but thatched roofs set upon the ground, with perhaps a mud chimney built separately on one end” (Millett 1980: 44-45). She later says that these huts are “…as unlike permanent residences as are the tents of the wandering Arabs” (Millett 1980: 49). This suggests that while the accommodation was temporary, there may be archaeological traces that remain in the form of a hearth or chimney. Millett also describes “…a woman with a child in her arms, stood at a hut door watching us as we drove by” (1980: 44). This implies that an entire family was living at this camp. One description however, cannot be extrapolated to mean that all sawpit sites accommodated whole families.

Other primary sources refer to timber camps but do not go into detail. For example, a number of police records make reference to timber camps but there is virtually no description of these camps, their composition, or how people used them. Police Record No. 129 3/891 from 1861 mentions a “…sawyer’s hut” situated deep in the bush, but little else. Millet’s description is the only one I have found that provides details.

There are numerous documentary sources that mention convict parties being allocated to work in the timber industry. For example, the Letter Book and Memo Book of Comptroller General, C3, Fremantle Prison, (described in Hasluck 2002: 107-108, original not seen) describes convicts arriving in the colony being allocated to work as sawyers. As with the police records the detail is limited.
I have located three primary sources that describe or show sawpit construction and use. The first from the journal of Robert Murray, fourth officer on the Endeavour, dating to 1795, describes sawpit technology in New Zealand (original not seen, in Fleet 1984: 35-36). The sawpit was used for cutting New Zealand Kauri and is described as follows:

…at each end of the pit were two poles angled up like the front poles of a tent. Blocks and tackles were arranged on each of these pairs of uprights to raise and lower the trunk. Underneath the trunk there were three wooden supports, laid across six barrels. The two sawyers worked the saw, one on top of the trunk and one underneath. The block and tackle were used to raise the log whenever they needed to move the barrels and supports as they sawed along the trunk (Murray 1795, original not seen, in Fleet 1984: 35-36).

Also from New Zealand is a Charles Healy painting (figure four) dating to 1839 which depicts a sawpit in use (in Fleet 1984: 36). The sawpit technology shown is different from that described in Murray’s journal, with the sawlog raised above the sawpit on a wooden frame instead of barrels. The sawpit in the painting has no block and tackle for raising the log. It is shown within the forest and adjacent to a hut and tree stumps.
The third primary source is a photograph of a sawpit (figure five) dating to 1911 from Bow River in the south-west of Western Australia (in Calder 1980: inserted plate). The sawpit is constructed in what appears to be level ground and has a rough timber frame and supports for the sawlog. A man in the sawpit is presumed to be standing, providing an indication of its depth, meaning that a person would have to crouch or kneel to operate the saw from underneath.
I have not found any primary descriptions of sawpit technology in the Canning Timber Concession. Nor have I found any other documentary sources that provide insight into the early timber industry, beyond those already discussed. There are however a number of secondary and scholarly sources which can be used to assist my research.

**Secondary and scholarly sources**

There are a number of histories that investigate the development of the Western Australian timber industry. Within these Mason is recorded, along with Yelverton
and Davies, as one of the first pioneers of the industry. However, there is far more discussion of Yelverton and Davies and their enterprises, than there is of Mason and the Canning Timber Concession. Presumably this is the result of the lack of documentary evidence relating to Mason and the Canning Timber Concession. What information can be derived from these histories is described below.

Robertson (1956) provides an overview of the development of the timber industry. Information about the Canning Timber Concession is generalised but there is one item of importance related to the relationship between private sawyers and timber companies. Robertson reports that Mason's timber concession was non-exclusive and that “...independent sawyers were allowed on the area, and ...the company complained of the great number of licenses granted to such sawyers” (1956: 10). Thus, it can be suggested that the sawpits within the Canning Timber Concession were not necessarily used by Mason's company, but possibly by private sawyers. Whether it is possible to determine this archaeologically is questionable, but my research design needs to consider that the people using the sawpit sites may not have been connected to Mason's company.

Thomas (1929) uses information from oral sources to discuss the development of the timber industry in Western Australia and mentions the Canning Timber Concession briefly. Writing in 1929, Thomas is likely to have spoken directly to
people who worked in the Canning Timber Concession. The historical accuracy of his sources is questionable as Thomas dates the arrival of the steam sawmill at Mason’s Mill to 1874 (1929: 38), when evidence exists to show it was set-up by 1868 at the latest (Slee and Shaw 1979: 14-15). So his report that “…all of the men on this mill with three exceptions were convicts,” (Thomas 1929: 38) must also be treated cautiously. At best it can be seen as confirmation that convict labour was used at Mason’s Mill.

I also use information from three histories written by amateur historians. Unlike scholarly histories these are written by people with an interest in history but without scholarly historical training. Due to this lack of formal training it is questionable whether sources used in these histories are treated critically. However, because they are specific histories of the development of the Kalamunda Shire, rather than overviews of the timber industry, they provide a greater level of detail about the Canning Timber Concession than the general histories. If used critically they can be of use.

The first of these histories, *Kalamunda of the Dreamtime*, by Frank McNamara (1961) is problematic, as McNamara states that “…I deem it unnecessary to encumber this book with reference to sources” (1961: preface). This makes it impossible to check the veracity of almost all of the information in this source. It contains definite historical inaccuracies, as McNamara incorrectly dates the invention of the whim to the 1860s, twenty years too early (1961: 2). However he
makes interesting statements about timber-getting activities and the people involved in them. For example, McNamara says that there were about “…100 men employed as fallers, sawyers, hewers and teamsters” (1961: 2) working for Mason in the 1860s. He also gives some details about the cutting, transportation and processing of timber, but they must be considered unreliable as it is impossible to checks his facts.

A history by McIntosh (undated) is equally unreliable. This pamphlet, produced by the Canning Historical Society, is undated and makes no reference to sources. Like McNamara (1961) it contains information which is impossible to verify. McIntosh (undated) and McNamara (1961) also contradict each other in a number of significant areas. Unfortunately, neither source can be relied upon and at best, should be used only when they can be verified by another more reliable source.

The third local history which describes timber-getting is Slee and Shaw's Cala Munda, a Home in the Forest (1979). This history cites its sources and provides information pertinent to my study. Slee and Shaw cite direct historical documents as the source of much of their information. As such, this source is more useful than both McIntosh (undated) and McNamara (1961). Care must be taken, as it draws on McNamara (1961) for some of its information. However, I consider Slee and Shaw (1979) to be a reliable source and have used it to provide general information about the Canning Timber Concession throughout this thesis.
There are a number of scholarly sources which discuss the development of sawpit technology and its retention in Britain. Pit-sawing is one of a number of timber processing technologies developed in Europe during the Middle Ages (Vines 1985: 29). The main requirement for its use was available labour. Mechanical sawmilling powered by wind or water has been used in Europe since at least 1250AD (Vines 1985: 29) but Britain was slow to adopt it, as “…English wood technique was extremely backward, the first sawmill not having been built until 1769 – there was one in Maine in the early seventeenth century,” (Lower 1973: 24). Older technology was retained due to severe wood shortages that occurred in Britain from the middle-ages, leading them to import most of their timber (Carroll 1973: 18). British pit-sawyers were extremely resistant to the introduction of new technologies (Lower 1973: 24) and the lack of a large timber industry in Britain required no real technological increases to be made. In the context of the industrialised world the sawpit was an archaic technology. The British colonists who arrived in Western Australia brought with them an expedient technology which could provide for immediate needs, but had limited use as a basis for large scale industry.

Slee and Shaw (1979) provide the only description of sawpit technology in the Canning Timber Concession. This description is unreferenced, there is no clear indication of its origin and as such, it cannot be checked. Slee and Shaw describe sawpits as having been between 6m and 9m long, 1.2m wide and more
than 1.2m deep. The sawlog was placed on wooden skids which supported above the sawpit (1979: 6). Slee and Shaw also discuss the difficulty of digging pits in the hard rocky ground of the local area suggesting it was “…unbelievably laborious…. uneconomic…and… time consuming” (1979: 6-8). As a result they suggest that sawpits in the Canning Timber Concession were often dug shallow and the dirt heaped up at either side to provide the necessary depth for working (Slee and Shaw 1979: 8).

There are two other descriptions of sawpit technology in historical sources. Calder (1980:20-21) provides an unreferenced description of sawpit technology as used in the south-west of Western Australia. She suggests that a pit or trench was dug near a number of trees to be felled, deep enough for a person to stand in it with the log at eye level, although, sometimes the sawpit was shallower and the bottom person would have to kneel or crouch. Often a drain was dug in the bottom of the pit to remove water and rough slabs were used to shore up the walls. Finally, saplings or small trees were used as rollers and supports (Calder 1980: 20).

Birmingham et al (1979: 180) describe sawpit technology used for processing cedar in New South Wales in the early to mid 19th century although the source of this description is unknown as it is not referenced within the text. They describe a process where sawpits are “…usually dug into the loose soil of a dry creek bed, 2m deep and 8m long” (Birmingham et al 1979: 180). The sawlog was then
placed on top of rollers made from saplings cut nearby (Birmingham *et al* 1979: 180).

<table>
<thead>
<tr>
<th>Design element</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Level ground near trees</td>
<td>Healy painting (Fleet 1984:36)</td>
</tr>
<tr>
<td></td>
<td>Level ground</td>
<td>Bow River photograph (Calder 1980: inserted plate)</td>
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<tr>
<td></td>
<td>Loose soil in a dry creek bed</td>
<td>Birmingham <em>et al</em> (1979: 180)</td>
</tr>
<tr>
<td></td>
<td>Near trees to be felled</td>
<td>Calder (1980: 20)</td>
</tr>
<tr>
<td>Technology</td>
<td>Block and tackle to raise sawlogs</td>
<td>Journal of Robert Murray (1795, original not seen, in Fleet 1984: 35-36)</td>
</tr>
<tr>
<td></td>
<td>Sawlog supported by wooden supports on barrels</td>
<td>Journal of Robert Murray (1795, original not seen, in Fleet 1984: 35-36)</td>
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<td></td>
<td>Sawlog supported by wooden frame</td>
<td>Healy painting (Fleet 1984:36)</td>
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<tr>
<td></td>
<td>Rough timber frame</td>
<td>Bow River photograph (Calder 1980: inserted plate)</td>
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<td></td>
<td>Sawlog supported by rollers made from saplings</td>
<td>Birmingham <em>et al</em> (1979: 180)</td>
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<tr>
<td></td>
<td>Drain in the base of the sawpit</td>
<td>Calder (1980: 20)</td>
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<tr>
<td></td>
<td>Walls shored with rough timber</td>
<td>Calder (1980: 20)</td>
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<td></td>
<td>Raised sides to allow shallower trench</td>
<td>Slee and Shaw (1979: 8)</td>
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<tr>
<td></td>
<td>Sawlog on wooden skids</td>
<td>Slee and Shaw (1979: 6)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Deep enough to stand in with the sawlog at eye level</td>
<td>Calder (1980: 20)</td>
</tr>
<tr>
<td></td>
<td>2m deep and 8m long</td>
<td>Birmingham <em>et al</em> (1979: 180)</td>
</tr>
<tr>
<td></td>
<td>6m to 9m long, 1.2m wide, 1.2m deep</td>
<td>Slee and Shaw (1979: 6)</td>
</tr>
<tr>
<td>Habitation</td>
<td>Rough thatched hut</td>
<td>Millet (1980: 44-45)</td>
</tr>
<tr>
<td></td>
<td>Hut near sawpit</td>
<td>Healy painting (Fleet 1984:36)</td>
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</table>

*Table two. Historical descriptions of sawpits*
There is clear diversity between the various historical and scholarly descriptions of sawpit technology, which I argue can be explained by Vines’ (1985: 29) theory of technological adaptation to local conditions. Following this argument, each individual description depicts a different technological adaptation. Based on this it is difficult to develop an historical model of sawpit construction. However collated information based on the historical descriptions is shown in table two.

**Conclusion**

In this chapter I have examined the historical sources relevant to my research. These sources are limited in number and provide only general descriptions of the timber industry in the Canning Timber Concession, sawpit technology, and the lifeways of timber workers in the forest. Despite this I have been able to determine that some sawpit sites were inhabited by timber workers and that convicts worked within the Canning Timber Concession. Additionally, historical records demonstrate a considerable variation in sawpit technology. Consequently, I have been unable to develop a single historical model for sawpits. The information derived from these historical sources will be used with that from the archaeological literature to develop hypotheses to be tested by field methods.
Chapter 4 - Methods

This chapter outlines the archaeological methods used to achieve my research aims. Based on my review of existing archaeological literature and historical sources I proposed five hypotheses to be tested. Methods were designed to gather data to test these hypotheses. Surface survey of seven archaeological sites located within the Canning Timber Concession was used to gather this data. Features and artefacts were analysed to gain a better understanding of site use and formation. Methods also aimed to overcome problems associated with vegetation obscuring ground visibility in the forest.

Hypotheses to be tested

The general aims of this research were to investigate the social and technological adaptations of sawpit sites. In order to achieve these aims, I developed five hypotheses to be tested during fieldwork. They are as follows:

1. Vines (1985) suggests that timber-getting technology is subject to two influences; that it can be seen to adapt to local conditions, and that local materials are quickly inducted into the timber getting process. I developed the hypothesis that an adaptation of sawpit technology would be seen, defined by local conditions and materials. Methods were designed to test for, and if found, to measure this adaptation.

2. Historical evidence for the physical organisation of sawpits in the landscape is generalised, but suggest that sawpits are located on level
ground near timber resources. I aimed to investigate the frequency and
distribution of sawpits, and what factors influenced their placement in the
forest. I thus developed the hypothesis that the placement of sawpits
would be primarily dependent on topography and the location of timber
resources to be exploited. Methods were designed to test this hypothesis.

3. Historical records are unclear as to when sawpit use began and ceased in
the Canning Timber Concession. The records suggest that timber
exploitation in the area began in the late 1850s or the early 1860s
(Robertson 1956: 6-10). Pit-sawing may have ceased when Keane took
over the Canning Timber Concession in 1891 (Slee and Shaw 1979: 44). I
developed the hypothesis that pit-sawing was used in the Canning Timber
Concession between 1850 and 1891. Field methods were designed to test
for the timing of sawpit use.

4. Historical documents suggest that some timber workers working at sawpit
sites in the forest also lived at these sites while they were in use. One aim
of this research was to test for evidence of habitation at sawpit sites, and if
found, the nature of this habitation. I developed the hypothesis that sawpit
sites will contain evidence of domestic activities, indicative of people living
at the sites. Site survey methods specifically tested for domestic evidence
at sites and recorded the nature of this evidence.

5. The work of Davies (2001a), Vines (1985), and Smith (2003) suggests that
timber workers were both isolated from, yet integrated within, colonial
society. Material culture remains at sawmill sites showed that timber
workers developed a practical and thrifty approach to their material culture, reusing and recycling artefacts. However, they were also integrated within society as demonstrated by the presence of certain luxury items. I developed the hypothesis that material culture at sawpit sites will show evidence of both the reuse and recycling of artefacts, and improvisation and adaptation to the jarrah forest environment. Additionally however, evidence would be seen of integration with the wider colonial society. Site survey methods were designed to test for these elements.

**Limits on methods**

Fieldwork methods were constrained by two main limitations; access to sites and time available to complete fieldwork. Sites were located on land owned or administered by a number of different organisations. Permission was sought for access to sites from the Shire of Kalamunda, Water Corporation, Department of Conservation and Land Management (CALM), and private land owners. Permission was given by all parties, although restrictions were placed on my research by the Water Corporation and CALM. These two organisations stipulated that no collection of artefacts or other material could be made from sites on their land. Additionally, access to sites within Reservoir Protection Zones around the Victoria Reservoir was prohibited, based on *The Water and Rivers Commission Statewide Policy No 13* (2003: 20). Consequently, I could not investigate two sites within this zone.
Due to time constraints predicated by honours study deadlines, a period of ten days was allocated for the completion of fieldwork. This time period affected the number of sites that I was able to survey. Site sample sizes were consequently affected by these time restrictions.

**The Sites**

In total seven sites were investigated. Six sites consisted of at least one sawpit feature, along with other associated archaeological material. The seventh site was an artefact scatter adjacent to a sawpit site. The sites were each designated by the project code “SPP” (sawpit project) followed by a number. Thus, site number one was “SPP1” and so on (table three). Sawpits within sites were designated using the project code for that site, followed by a lower case letter. Thus, the two sawpits at site SPP1 are designated as sawpits SPP1a and SPP1b.

The sites are all located in mixed jarrah and marri forest. This forest is characterised by an upper story consisting of jarrah (*Eucalyptus marginata*) and marri (*Eucalyptus resinifera*) trees, a middle story of *banksia, dryandra, xantherohea* and *aquafolia* species and lower story vegetation comprising various species of grasses and shrubs. The combination of lower story vegetation and leaf litter from the tree species combine to provide a very thick ground cover which severely affects ground visibility.
### Site selection

All seven sites were located within the 129,310 acre (52,330ha) Canning Timber Concession. Sawpits are numerous within this area. As Slee and Shaw state, the “…the bush is still dotted with these pits in the forest south of Kalamunda” (1979: 7), and a total of 14 sawpit sites were known from anecdotal evidence. A sample of six sawpit sites was investigated determined largely by the amount of time available for fieldwork. This sample is highly stratified as the sites were previously known and not found during field survey. I developed a system to classify sawpit preservation (discussed in detail later in the chapter) and after a
preliminary investigation of all 14 sites, selected six sawpits with good preservation, and thus, more potential to achieve the research aims relating to technology.

This sample is too highly stratified to provide appropriate information about sawpit distribution and density within the forest. I thus conducted a single field survey to test the landscape for sawpit density. The State Forests Department filled in numerous sawpits located in state forest during the 1960s and 1970s (Forests Department Information Kit, undated). I thus chose to survey a six hectare piece of bushland outside the state forest, administered by the Shire of Kalamunda and located between Palmateer Drive and Hallendale Road in Walliston. One sawpit (site SPP6) was known to be located on this land and the entire area had been logged. Hazard reduction burns are also conducted on this land on a rotational basis, so ground visibility of better than 30% was possible over most of the six hectares. I walked survey transects at an interval of 30m in an attempt to locate unknown sawpits. Data recovered from this survey was combined with that from the six sampled sites to attempt to determine sawpit distribution in the forest.

**Visibility, sampling and survey strategy**

Byrne suggests that in Australian forests, “…visibility is liable to be particularly poor in logged areas where thick regeneration growth and unharvested timber obscure the ground” (1984: 64). The Darling Scarp forest has been logged
numerous times and my preliminary investigation of sites indicated that a strategy was required to mitigate poor ground visibility. Six of the seven sites were heavily vegetated and three sites (SPP3, SPP6, SPP7) had ground visibility of less than 5%. Three sites (SPP1, SPP2, SPP5) had ground visibility of less than 30%. The final site (SPP4) had ground visibility of 80%. Thus, for six of the seven sites the identification of archaeological material on the ground was extremely difficult. Larger artefacts such as bottles and steel cable were reasonably easy to see, but smaller items such as glass, ceramic and metal fragments were virtually invisible. As Schiffer et al suggest vegetation cover can reduce the chance of recovering archaeological material to almost zero (1978: 7). For example, Terrenato and Ammerman (1996) demonstrated in their site survey in the Italian region of Cecina, that ground vegetation considerably reduces the possibility of finding sites. In their study, surface survey recorded an average of 4.86 sites per square kilometre on land with light vegetation cover or less. Conversely, on land with heavy vegetation cover, only 0.18 sites were recorded per square kilometre (Terrenato and Ammerman 1996: 99). They suggest that, when dealing with areas of heavy vegetation cover, survey strategies must account for reduced visibility (Terrenato and Ammerman 1996: 106). Schiffer et al suggest a number of strategies to increase visibility, including the removal of vegetation and searching areas previously opened for tracks and roads (1978: 7). I adopted both of these strategies. Fire access tracks running through sites were searched intensively. Additionally, vegetation was removed from eight
individual metre squares within each site to determine if archaeological material was hidden underneath.

A sampling strategy which determined the layout and distribution of features and artefacts within sawpit sites was required. I canvassed various probabilistic sampling methods and determined a strategy following Orton (2000), who provides an exhaustive overview of sampling methods and theory. Orton suggests that “…the total size of the sample must be determined on an individual basis…(and that)…there is no statistical rationale whatever for any particular sampling fraction” (2000: 120-121, author's italics). Rather, he suggests that the size of a sample and the strategy used to determine this sample should be determined by the requirements of the research design (Orton 2000: 121). For my study of sawpits, the sampling strategy was predicated by three requirements; to deal with the issue of visibility; to examine the distribution of artefact types across a site; and to determine artefact function.

Orton defines “an invisible site” as one in which there are “…few if any surface indications as to the extent or the nature of the site” (2000: 126). I consider this definition to apply to sawpit sites due to poor ground visibility. It is necessary to define a site boundary at invisible sites to enable a sampling strategy to be developed. Orton suggests that it is reasonable to estimate “…the area of the site, a figure to which reasonable limits could be reasonably attached,” (2000: 129). Following this I defined an arbitrary site area of a 40m² grid with the sawpit
at its centre. I considered that material within this area could reasonably be associated with the sawpit. However, as this area was determined arbitrarily material associated with the sawpit may still exist outside 40m$^2$ grid. Therefore four 100m transects were walked away from the sawpit in the direction of the cardinal points. Additional transects were walked between these cardinal points, to a total of eight 100m transects for each site.

Orton suggests that for invisible sites, a systematic sample is superior to a random one (2000: 133). A random sample is more likely to cluster information whereas a systematic sample covers the entire area of a site equally. Consequently I used a systematic sampling strategy to investigate sawpit sites. Within the 40m$^2$ grid each square metre was intensively searched through a process of field walking. Additionally, vegetation was removed in eight individual 1m squares, or 0.5% of the total 1600 square metres within the sample area. This is only a small area of the site, but I considered the combination of the two methods to be an appropriate strategy. The selection of squares was systematic. Each site was divided into four quadrants and vegetation removed from two squares in each quadrant. Of these two squares, one was within 0-10m of the sawpit and the other within 11-20m of the pit. No individual square could be located immediately adjacent to another. The intention was to ensure the greatest possible coverage of the sample area within the time available. I considered that the combination of field walking each square and vegetation removal in eight additional squares would mitigate the visibility problems. This
strategy was successful in areas with ground visibility of greater than 25% but proved insufficient in areas where ground visibility was less than that (to be discussed at length in chapter seven).

All archaeological material discovered during the survey process was recorded in situ. Artefacts and features were fully described, photographed and plotted onto a site plan using a dumpy. This allowed the distribution of artefacts across the site to be seen. Where artefacts had particular diagnostic features, these were also carefully recorded.

**Sawpit recording**

Sawpit dimensions were recorded through levelling using a dumpy. Sawpits were measured in three dimensions and construction elements such as rock or stone buttressing were recorded, as were any other unusual technological aspects. I developed a system for recording sawpit integrity in order to attempt to understand post-depositional site formation processes. Using sediment colour and texture as indicators of stratigraphic change (Schiffer 1983: 689-690) it was determined that all sawpits were dug into a single clay/gravel strata. Schiffer (1987) discusses site formation processes affecting the preservation of pits, although he suggests caution as he bases his discussion on data from England. He suggests that the steep walls of pit structures such as sawpits erode rapidly due to frost action and flowing water. This erosion will be most prevalent at the top of the wall and eroded sediment fills the pit (Schiffer 1987: 218).
For sawpits an examination of the pit wall is indicative of the level of degradation suffered since construction. Changes in soil colour, texture, fabric, compaction and permeability (Schiffer 1983: 688-691) were used to determine pit wall degradation. I consider the original wall, representing the original construction of the sawpit, to be that displaying a straight vertical cut (figure seven). The percentage of original wall that had not suffered obvious erosion was recorded. Sawpits with more than 50% of original wall were considered to have good integrity. Sawpits with between 1% and 49% of original wall left were considered to have fair integrity. Sawpits with no original wall were considered to have poor integrity. This measure was important because it allowed comparison between sawpits which considered site formation processes.

Figure six. Original wall sawpit SPP5a
Finally, historical records suggested that sawpit placement was dependent on the location of timber resources. Thus, the number of tree stumps within a 10m radius of the sawpit was recorded. The number and location of these stumps was compared between sawpits to determine if sawpit placement was dependent on timber resources.

**Site SPP4**

Site SPP4, a small artefact scatter, is located 48m to the east of site SPP3, and I decided to investigate it as a separate site. This site’s proximity to the sawpit at site SPP3 suggested the two may be connected, but I considered that they were separated by too great a distance to investigate them as one site. As this site contained no sawpit, a separate survey strategy was required for its investigation. A seven metre by nine metre grid of one metre squares was laid down over the scatter to encompass all visible artefacts. The number of artefacts in each grid square was counted in order to determine artefact densities across the site. Eight individual squares were then sampled and all artefacts within them recorded. The eight squares chosen were those with the highest number of artefacts. Individual artefacts with obvious diagnostic features from other squares were also recorded. The aim was to record the range and type of artefacts present, and artefact densities across the site.
Artefact classification

I developed a simple system for classifying artefacts. Artefacts were classified in order to determine use, form and function, and diagnostic features that could be used to date sites. South suggests that the range of artefacts present at a site and their function infers site usage (1979: 231). For example, the presence of a wide range of domestic artefacts at an industrial site such as a sawpit would suggest activities beyond those predicated by industrial processes. Analysis of artefact function tests for evidence of habitation, the reuse and recycling of artefacts, and improvisation and adaptation to forest life.

My classification system was based on that used by Davies (2001a) but was greatly simplified due to a much smaller number of artefacts. Davies' classification system was appropriate because he primarily aimed to determine artefact function, and contextually, the site types and artefacts recovered are similar. A number of other sources including South (1979), Lawrence (1998) and Crook et al (2002) were also consulted in developing this system of classification.

Artefacts were classified into one of three classes:

*Domestic* – Artefacts associated with domestic activities, such as eating, drinking, leisure, and social activities

*Industrial:* Artefacts associated with timber-getting activities, such as tree felling and timber processing
*Other* – Artefacts which cannot be identified, or do not relate to the use of the sawpit.

<table>
<thead>
<tr>
<th>Class:</th>
<th>Form:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic – Food</td>
<td>Bone</td>
</tr>
<tr>
<td>Domestic – Storage</td>
<td>Barrel hoop iron</td>
</tr>
<tr>
<td></td>
<td>Bottle – alcohol</td>
</tr>
<tr>
<td></td>
<td>Bottle – carbonated liquid</td>
</tr>
<tr>
<td></td>
<td>Bottle – condiment</td>
</tr>
<tr>
<td></td>
<td>Bottle – other</td>
</tr>
<tr>
<td>Domestic – Tableware</td>
<td>Plate</td>
</tr>
<tr>
<td></td>
<td>Other ceramic</td>
</tr>
<tr>
<td>Industrial – Hardware</td>
<td>Cable</td>
</tr>
<tr>
<td></td>
<td>Fastenings</td>
</tr>
<tr>
<td>Industrial – Personal</td>
<td>Safety Wear</td>
</tr>
<tr>
<td>Industrial – Sawpit construction</td>
<td>Stone</td>
</tr>
<tr>
<td></td>
<td>Timber</td>
</tr>
<tr>
<td>Industrial – Sawpit use</td>
<td>Timber</td>
</tr>
<tr>
<td>Other</td>
<td>Miscellaneous</td>
</tr>
</tbody>
</table>

**Table four. Artefact classification by function. Based on Davies (2001: 64)**

Within these classes, artefacts were divided by function. Where function could not be supposed, fabric was used as a classificatory tool. Table four shows the various artefact functional classes used.

All artefacts were recorded in the field and no artefacts were collected. Thus, some level of interpretation was required to be made for almost every artefact in the field. All artefacts were described as fully as possible, and those with obvious diagnostic features (e.g., bottle neck and bases) were drawn and/or photographed. Numbers of fragments and minimum number of items was recorded within artefact classes. Field constraints meant that the weight of artefacts was not recorded.
Conventions for identifying, describing and analysing glass artefacts followed Hutchison (1987), Boow (1991) and White (2000). Diagnostic features on glass artefacts were used to provide approximate dates for site use.

**Data recording**

The inability to collect artefacts during survey made the accuracy of data recording highly important. As Singline suggests “the need to record a site and its elements accurately, before, during and after archaeological impact is absolutely crucial to the later analysis and interpretation of the site” (1987: 130). Thus, a data recording strategy was developed before fieldwork commenced. Four recording forms were developed that sought to capture all appropriate data, and organise them in a way that was easy to later understand. Following Davies and Buckley (1987: 29-30) recording was broken into two levels; recording at site level, and recording at feature level. General site information was recorded on a Site Recording Form (Appendix 1a), while specific information was recorded on a Feature Recording Form (Appendix 1b). A Sawpit Recording Form (Appendix 1c) was developed, specifically for the recording of sawpit features. Finally, a Sample Square Recording Form (Appendix 1d) was developed to record the details of each random sample square investigated. While the recording forms were unique to this project they were developed based on Davies and Buckley (1987), Burke and Smith (2004), and unpublished recording forms developed by Paterson for the ‘Historical Archaeology of the Pilbara Project’. Additional information was
captured on forms taken directly from Burke and Smith (2004: 340-41, 354-55) including an Environmental Background Recording Forms, a Level Booking Form, and a Photographic Recording Form. Additionally, a fieldbook was kept to record any data not reflected on the forms, including general impressions of fieldwork, techniques used and contextual information.

**Conclusion**

This chapter has described the methods used during fieldwork. These methods were used to investigate six sawpit sites and one artefact scatter. Methods were designed to achieve the aims of the research and test five hypotheses developed from historical documents and previous archaeological research. Methods were also designed to mitigate the problem of thick bush limiting ground visibility. The efficacy of these methods will be discussed in chapter seven.
Chapter Five – Archaeological results

This chapter describes the results of fieldwork and subsequent analysis of archaeological material. I first present the results related to sawpit distribution, followed by the data from each individual site. Finally I present data relating to sawpit technology. These results and my hypotheses are discussed in chapter six.

In total, seven sites were investigated (table three). I characterised six of these as sawpit sites, or sites which contain at least one sawpit feature. The seventh site was an artefact scatter associated with, but not definitively linked to, one of the sawpit sites. One of the most distinctive aspects of the archaeology of the sawpit sites was the small amount of related artefactual evidence. In all cases there were only a very small number of artefacts associated with the sawpits (appendix two). The only exception to this trend was at site SPP4 which comprised an artefact scatter and may be associated with the sawpit at site SPP3. Thus, the primary forms of evidence at each sawpit site are the sawpits themselves and their technological characteristics.

Sawpit distribution

I conducted a field survey in six hectares of forest located between Palmateer Drive and Hallendale Road in Walliston to test for the distribution of sawpits in the landscape (figure seven). This land has level topography with a maximum
incline of two degrees across the entire six hectares. Using transects walked at 30m intervals, I located two sawpits positioned approximately 100m apart. No other sawpits were found during this survey. The results of this survey suggest that, for this piece of land, sawpits are not distributed evenly in the landscape. This is reinforced when data from all sites is considered. At sites SPP1 and SPP2 three sawpits are located within a one hectare area (figure eight). At site SPP5 two sawpits are located 35m apart (figure fifteen). All other sites contain individual sawpits. Thus, the density of sawpits in the landscape is not regular. Other factors which may result in sawpit placement are shown in table five.
Topography is the only factor which is similar across all sites. The number of tree stumps within a 10m radius of each sawpit varied from a minimum of five to a maximum of fourteen. Additionally, at each site there were also numerous tree stumps outside the 10m radius, although these were not counted. This would suggest that sawpits are not distributed based on timber resources until the size of tree stumps is considered. In all cases sawpits were located within two metres of one very large tree stump, with a minimum diameter of one point five metres. In all cases this stump was the largest in the immediate area. I thus interpret sawpit placement to be dependent on two factors; level ground and the largest available tree in any particular area.

Sites SPP1 and SPP2

These two sites are situated northwest of the corner of Glenisla and Canning Roads in Carmel (figure eight). They were recorded separately but data from both has been combined due to their close proximity to one another and because of the nature of archaeological evidence recorded at the sites. The 40m² grids
surveyed at each site overlap and analysis of artefact distribution shows no clear boundary between the two sites. The site complex comprised three sawpits, two recorded in site SPP1 and one in site SPP2. Of the three sawpits, SPP1a and SPP2a had fair preservation, while SPP1b had poor preservation. The site was covered with medium scrub and ground visibility was variable over the entire area of the complex ranging from 50% to 10% (figure eight).

In total 155 artefacts were recorded in the survey area. However, of these 130 appeared to be the result of rubbish dumping in the second half of the 20th century, based on identifying marks such as labels and maker’s marks. For example an intact beer bottle was recorded that dates to the mid 1990s. These
Artefacts were all found in two zones on the south and east sides of the survey area, adjacent to the two roads.

Only twenty five artefacts within the survey area could be considered contemporary with the use of the sawpits themselves (table six). Artefacts classified as industrial included five pieces of sawn timber, an item identified as a glass lens, possibly from a pair of goggles or glasses, and a heavy iron rivet. The rivet however, was found on top of a sawn log, and appeared to be in a position of secondary deposition. Artefacts classified as domestic included twelve fragments of bottle glass, metal bands interpreted as barrel hoops, and four bone fragments. Three fragments of the bottle glass were attributed to a single alcohol bottle. The MNI has been calculated where appropriate.

<table>
<thead>
<tr>
<th>Class</th>
<th>Form</th>
<th>Qty</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic – Food</td>
<td>Bone</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Domestic – Storage</td>
<td>Barrel hoop iron</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Bottle – alcohol</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Bottle – other</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Industrial – Hardware</td>
<td>Fastenings</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Industrial – Personal</td>
<td>Safety Wear</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Industrial – Sawpit use</td>
<td>Timber</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Animal Bone</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

Table six. SPP1 and SPP2 artefacts

Of the five bone fragments, four were identified as bovine, while the fifth was a long bone from a small unidentified animal. Taphonomic analysis of the five bone fragments suggests they were introduced to the site by human agency. The four
bovine fragments had been butchered. Three of the four could be refitted and comprise the proximal end of a bovine femur. This femur had been sawn lengthwise in half and across the centre of the bone (figure 9). All four bovine bones were considerably weathered but examination in the field found no evidence of gnawing. The long bone from the small unidentified animal displayed no sign of butchery, although there was evidence of gnawing. It had been cracked open along its long axis, presumably so the marrow could be removed. I interpret this bone as having been introduced to the site by a natural process rather than a cultural one. All of the bones were located in an area of the site where no obvious rubbish dumping had taken place.

Figure nine. Butchered bovine bone SPP1
The survival of these bones in a surface context must be questioned. Hesse and Wapnish list a number of taphonomic processes affecting bone survival in archaeological sites including gnawing by scavengers, trampling, exposure to weather, moisture levels, and the chemical environment of sites (1985: 24-28). While the bovine bones were weathered they were in reasonably good condition and do not appeared to have suffered from any other taphonomic processes. Given the survival of wooden artefacts at the site it is reasonable to interpret these bones as having been deposited during the use of the sawpit.

The presence of butchered bone, bottle glass and hoop iron implies the consumption of food and drink at the site. However, the number of artefacts and the distribution of the assemblage argues against habitation at the site. Artefacts are not clustered in a scatter but rather appear to have been discarded individually. The assemblage lacks complexity with only a small number of artefact types present. My interpretation of this artefact assemblage is that it does not provide evidence for habitation at this site. Likewise the artefacts show no evidence of re-use, recycling or improvisation.

Site SPP3

This sawpit site is situated in heavy jarrah scrub, 200m south of the corner of Canning Mills Road and Canning Road, in Canning Mills. The site consisted of a single, well preserved sawpit (SPP3a), around which a 40m² area was surveyed. A fire access track known as Springdale Road runs north-south through the
middle of the site. The site was heavily vegetated and ground visibility was no more than 10% west of Springdale Road, and no more than 2% east of Springdale Road (figure ten).

A total of eleven artefacts were recorded at this site. However, this included a car engine and a glass shower screen, which I attributed to recent dumping at the site. The other nine artefacts were all pieces of sawn timber (table seven) and were classified as industrial. No domestic artefacts were recorded. Seven of the timber artefacts were small fragments less than 200mm along their longest axis.
The eighth artefact was approximately 400mm along its longest axis. The ninth artefact was a log, over a metre long and 180mm in diameter. Interpretation of these artefacts was difficult due to their preservation. They were all clearly artefacts, probably by-products of the pit-sawing process. Eight artefacts displayed evidence of burning and two displayed the cut pattern created by a straight hand held saw, as shown in Burke and Smith (2004: 179), which links these artefacts directly to the sawpit.

<table>
<thead>
<tr>
<th>Class</th>
<th>Form</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial – Sawpit Use</td>
<td>Timber</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td><strong>Total:</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

**Table seven. SPP3 Artefacts**

As with sites SPP1 and SPP2 there was no artefactual evidence for habitation at this site. However, approximately 50m to the east of site SPP3 was an artefact scatter which may be related to the use of this sawpit. That artefact scatter was investigated as site SPP4.

**Site SPP4**

This site consisted of a tightly clustered artefact scatter located approximately 50 metres to the east of the sawpit at site SPP3. Ground visibility was approximately 80% due to a recent bushfire that removed vegetation and leaf litter. This was fortuitous because it is unlikely that this site would have been found if ground visibility had been 2% as at site SPP3.
The site was investigated using a seven metre by nine metre grid (64 individual metre squares). Of these squares 25 contained artefacts (figure eleven). A total of 294 artefacts were counted at this site, of which 158 were analysed in eight sampled squares. When averaged across all 25 squares mean artefact density was 11.76 artefacts per square. However, 85% of all artefacts are distributed across just 8 squares (D3, D2, E2, F4, F3, F2, G4, I4). In these squares artefact density is 31.5 artefacts per square. 32% of all artefacts were recovered from one square (E2) alone. Schiffer suggests that “…habitation sites produce mainly secondary refuse” (1987: 60) as living areas are cleared and refuse deposited in one location. The clustering of artefacts in a geographically limited area at this site suggests they were deposited as secondary refuse.

![Figure eleven. Artefact densities, SPP4]
Analysis of the assemblage by function shows a limited range of artefacts. Only one artefact in the assemblage was classified as industrial. This was a wedge shaped piece of sawn timber, interpreted as a tree scarf (figure twelve). A scarf is cut from the trunk of a tree as part of felling operations. All other artefacts were classified as domestic. These included alcohol, carbonated water and condiment bottles, barrel hoop iron, and earthenware and stoneware ceramic tableware. While there were no whole artefacts, there were numerous large fragments with diagnostic features enabling identification.

Table eight shows artefact numbers and MNI recorded in the eight sampled squares. Analysis by MNI shows this assemblage to have a minimum of 26 separate items. All are related to the storage, or serving of food and beverages. However, the limited range of these artefacts and the relatively low MNI suggests
a short term site occupation. Due to this and the clustering of items I interpret this scatter as representing the secondary refuse of a camp site. Lawrence Cheney reports that short term miner’s campsites left similar discrete scatters of ceramic, glass and metal artefacts in low numbers (1995: 128-129).

<table>
<thead>
<tr>
<th>Class</th>
<th>Form</th>
<th>Qty</th>
<th>MNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic – Storage</td>
<td>Barrel hoop iron</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Bottle – alcohol</td>
<td>91</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Bottle – carbonated liquid</td>
<td>30</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Bottle – condiment</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>Domestic – Tableware</td>
<td>Plate</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Other ceramic</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Industrial – Sawpit use</td>
<td>Timber</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>158</strong></td>
<td></td>
</tr>
</tbody>
</table>

Table eight. SPP4 Artefacts

Figure thirteen. Refit of three glass artefacts recorded at site SPP4
This site can be dated using the known age of glass artefacts. Nine different diagnostic features were identified within the assemblage that enabled dates to be calculated. Some glass artefacts were refitted which aided in identification (figure thirteen). Dates for glass bottles are shown in table nine and figure fourteen. Based on the presence of the Melbourne Bottle Glass Company bottle, the earliest possible date the site could have been inhabited is 1872 (Boow 1991: 180). All five of the recognisable Codd bottles in the assemblage had the original Codd neck shape, rather than the later variants. This would suggest a date earlier in the Codd bottle manufacture sequence. Codd bottles were manufactured until 1930 (Jones and Sullivan 1989: 161), but the presence of the single black glass bottle base and the cobalt blue bottle, would suggest a 19th century date.

<table>
<thead>
<tr>
<th>Artefact</th>
<th>Diagnostic Feature</th>
<th>Date Range</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codd bottle</td>
<td>Codd bottle patent</td>
<td>1870-1895 (mid point 1883)</td>
<td>Talbot 1974: 46-50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Jones and Sullivan 1989: 161</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Boow 1991: 74-78</td>
</tr>
<tr>
<td>Codd variants</td>
<td></td>
<td>1870 -1930 (mid point 1900)</td>
<td>Burke and Smith 2004: 367</td>
</tr>
<tr>
<td>long necked</td>
<td>colour</td>
<td>1845 onwards</td>
<td>Burke and Smith 2004: 369</td>
</tr>
<tr>
<td>cobalt blue bottle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bottle base</td>
<td>colour: “black glass”</td>
<td>1830-1870</td>
<td>Burke and Smith 2004: 369</td>
</tr>
</tbody>
</table>

Table nine. Glass artefact dates SPP4
The manufacture dates for black glass and the Melbourne Bottle Glass Company bottle do not overlap. The black glass bottle was thus not used to date the site. The manufacture dates for Codd bottles, Codd variants, cobalt blue bottle and Melbourne Bottle Glass Company bottle were determined. The mid point in each manufacture sequence was calculated and then averaged across the four dates. The mean of these mid points was calculated as the year 1884 (+/- 7 years to one standard deviation). This date suggests that the site was occupied contemporary with the use of pit-sawing in the area.

<table>
<thead>
<tr>
<th>Artefact</th>
<th>1830</th>
<th>1840</th>
<th>1850</th>
<th>1860</th>
<th>1870</th>
<th>1880</th>
<th>1890</th>
<th>1900</th>
<th>1910</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codd bottle</td>
<td>I----</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.G.B.Co. bottle</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Codd variants</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>cobalt blue / colour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>black glass</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure fourteen. SPP4 glass artefact date ranges**

The black glass bottle provided the only evidence for artefact reuse and recycling at the site. The manufacture of this type of glass ceased by 1870 (Burke and Smith 2004: 369) and if we accept 1884 as a possible occupation date for the site, this artefact had been recycled for a minimum of fourteen years. Even the date of 1872 is outside the manufacture range. However, this is the only artefact in the assemblage that suggests reuse and recycling. While other artefacts may have been recycled there is no evidence for this in the assemblage.
Based on the function, distribution and range of artefacts present, I interpret site SPP4 as secondary refuse for a short term campsite, probably occupied during the early 1880s. While no hearth or other architectural evidence was recorded, the artefact assemblage suggests that food and beverages were consumed at the site in reasonable quantities. Links between this scatter (SPP4) and the sawpit (SPP3) will be discussed in chapter six.

**Site SPP5**

This site is situated approximately 1.5km to the northwest of the Canning Mills townsite, in the jarrah forest. Access to this site can only be made via fire access tracks from Canning Mills Road. It is situated on the border of the Victoria Reservoir Protection Zone, which meant that recording of this site was of a limited nature. The site consists of two sawpits (SPP5a, SPP5b) situated 35m apart (figure fifteen). A fire access track runs through the centre of the site. Only the technological aspects of the two sawpits were recorded. The 40m² grid system was not used, nor was the strategy of sample squares employed. Ground visibility at the site was approximately 10%. Only one artefact was recorded, a four metre length of heavy steel cable, interpreted as having an industrial function, possibly used to move heavy timber logs around the site.

There was a long shallow depression approximately 40m to the south of SPP5a, which may once have been a sawpit. The depression was no more than 20cm deep along its entire length and as it was aligned east-west with the slope, may
be the result of water run-off. It was impossible to suggest that this feature was definitely a sawpit and has been excluded from any discussion.

![Figure fifteen. Site plan SPP5](image)

**Figure fifteen. Site plan SPP5**

**Site SPP6**

This site is situated 30m south of Palmateer Drive, in Walliston, 200m east of the junction with Grove Road. It consists of a sawpit (SPP6a) situated in jarrah forest with an under story of heavy *dryandra* scrub (figure sixteen). Ground visibility was zero except on the fire access track which runs east-west through the middle of the site. Investigating this site was difficult due to very thick scrub. Aside from
causing visibility problems, the closeness of the *dryandra* scrub surrounding the sawpit made movement difficult.

Figure sixteen. Site plan SPP6

Only one artefact was found in the bush areas of the site and this was the front end of a Holden FB car. Sample squares failed to uncover any other artefacts in the heavy scrub, although a close examination of the fire access track recovered 15 fragments of glass each less than 20mm at the longest axis (table ten). This track is graded annually (Shire of Kalamunda Rangers, personal communication), which would account for the fragmentary nature of these artefacts. It was impossible to infer functional aspects from the glass fragments,
due to their size and only information related to the fabric of the material was recorded.

<table>
<thead>
<tr>
<th>Class</th>
<th>Form</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic – Storage</td>
<td>Bottle – other</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Table ten. SPP6 Artefacts

**Site SPP7**

This site is situated 50m to the west of Alan Anderson Park in Walliston (figure seventeen).

Figure seventeen. Site plan SPP7
It consists of a sawpit (SPP7a) located in jarrah forest with an under story of heavy *dryandra* and *aquafolia* scrub. A fire access track runs east-west through the middle of the site. As with site SPP6 the thick scrub made movement around the site very difficult and ground visibility was virtually zero except on the fire access track.

<table>
<thead>
<tr>
<th>Class</th>
<th>Form</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic – Storage</td>
<td>Bottle – other</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total: 11</td>
</tr>
</tbody>
</table>

**Table eleven. SPP7 Artefacts**

Surface survey recorded only two large artefacts in the heavy vegetation. These were both car parts and I considered them unconnected with the sawpit. As with SPP6, sample squares failed to uncover artefacts in the scrub areas of the site and the only artefacts were found on the fire access track (table eleven). These were 11 fragments of glass, each less than 20mm on their longest axis.

**Investigation of individual sawpits**

The technology of sawpit construction and use was investigated through an examination of the individual sawpits at each site. The dimensions and materials used in the construction of each sawpit were recorded. Sawpit dimensions are shown in table thirteen and figures eighteen and nineteen.
Figure eighteen. Sawpits side view
Site formation processes were considered. All sawpits were dug into the same soil type, consisting of clay and gravel. All sawpits demonstrated erosion in which the sides had collapsed into the base of the sawpit. The amount of original wall
remaining was examined in order to determine the level of sawpit degradation.

All sawpits had some original wall left except SPP1b. The good integrity of sawpits SPP5a and SPP6a suggests virtually no infilling. All sawpits, with the exception of SPP1b, had an average of 31% original wall intact, allowing the original floor level to be seen in some areas of each sawpit. The original floor level at sawpit SPP6a was demonstrated by the wooden structure situated at the centre of the trench floor (figure twenty). I consider that, with the exception of SPP1b, the recorded dimensions for each sawpit reflect their original size.

A reasonably large variation can be seen in the dimensions of length and width across the eight sawpits (table twelve, figures eighteen and nineteen). There is a 9m difference between maximum and minimum length, and a 2.3m difference between maximum and minimum widths. However, there is minimal variation in depth with only a 50cm difference between maximum and minimum depths. Maximum sawpit depth is only 125cm while minimum depth is 75cm. The various historical descriptions of sawpit depth given in chapter three suggest a regular

<table>
<thead>
<tr>
<th>Sawpit</th>
<th>Length</th>
<th>Width</th>
<th>Depth</th>
<th>% Original Wall Intact</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPP1a</td>
<td>7m</td>
<td>1m</td>
<td>0.8m</td>
<td>35% - fair condition</td>
</tr>
<tr>
<td>SPP1b</td>
<td>4.5m</td>
<td>1.5m</td>
<td>0.75m</td>
<td>0% - poor condition</td>
</tr>
<tr>
<td>SPP2a</td>
<td>10m</td>
<td>2.5m</td>
<td>0.89m</td>
<td>25% - fair condition</td>
</tr>
<tr>
<td>SPP3a</td>
<td>13m</td>
<td>3m</td>
<td>1.25m</td>
<td>25% - fair condition</td>
</tr>
<tr>
<td>SPP5a</td>
<td>13.5m</td>
<td>3.3m</td>
<td>1m</td>
<td>60% - good condition</td>
</tr>
<tr>
<td>SPP5b</td>
<td>12.7m</td>
<td>2.3m</td>
<td>1m</td>
<td>25% - fair condition</td>
</tr>
<tr>
<td>SPP6a</td>
<td>9.4m</td>
<td>2.8m</td>
<td>1m</td>
<td>50% - good condition</td>
</tr>
<tr>
<td>SPP7a</td>
<td>10.4m</td>
<td>2.5m</td>
<td>1.05m</td>
<td>25% - fair condition</td>
</tr>
</tbody>
</table>

Table twelve. Sawpit Dimensions
depth of closer to two metres. The eight sawpits surveyed for this research are all considerably shallower than that.

Figure twenty. Wooden structure in floor of sawpit SPP6a

Four sawpits had raised sides (SPP1b, SPP2a, SPP5a, SPP6a) as described in Slee and Shaw (1979: 8). In three cases both sides of the sawpit were between 10cm and 40cm above the surrounding ground surface. Sawpit SPP5a however, had only the east side raised, approximately one metre above the surrounding ground surface. I attributed this to the sawpit being dug across a slope meaning the east side needed to be raised to reach the level of the west side.
Sawpit SPP6a had two construction elements not seen in any of the other sawpits. The walls were buttressed with large stone blocks (figure twenty one) which have maintained the integrity of the trench. These blocks do not run the entire length of the sawpit but are situated through the centre of the trench.

Figure twenty one. Rock buttressing sawpit SPP6a

Additionally a square wooden structure is located in the centre of the sawpit floor (figure twenty). This was constructed of four rough sawn timbers without nails and is approximately 1m by 60cm square. It is between 15cm and 20cm deep.
This wooden square is situated in the deepest part of the sawpit, in a central position. The purpose of this structure is unknown, but it may possibly be a water drain as described by Calder (1980: 20). The rock buttressing is different from the other sawpits, which all have bare earth walls cut vertically down into bare earth (figure six). Calder describes timber slabs being used as buttressing for sawpit walls in the south-west of Western Australia (1980: 20) but no evidence for this was recorded at these sites. Timber slabs may have been removed from sawpits when they ceased operation and reused at other sawpits. Alternatively, the very hard local soil may have made buttressing unnecessary as there may have been little danger of collapse. The good preservation of the sawpits investigated as part of this research would attest to their durability. However, these are guesses based on the historical evidence. There is no archaeological evidence at these sites that supports the use of wood buttressing.

**Conclusion**

This chapter has described the archaeological results recorded during the investigation of seven sites in the Canning Timber Concession. Six sawpit sites and one artefact scatter were recorded and analysed. At each sawpit site, artefactual evidence was limited and the main form of evidence were the sawpits themselves. These results are thus able to achieve the aims of this research relating to the technological processes of the timber industry, but are limited in their ability to achieve those aims relating to the lives of timber workers. Discussion of these results will take place in chapter six.
Chapter Six - Discussion

In this chapter I will discuss the archaeological and historical evidence recovered during my research. I commenced this research with the aims of investigating the organisation and technology of the early timber industry of the Canning Timber Concession, and the domestic lives of the people who worked in that industry. I developed five hypotheses based on previous archaeological research and historical records, to be tested by archaeological data recovered during fieldwork. Three hypotheses were designed to investigate sawpit technology. The first related to technological adaptation, the second to sawpit distribution and organisation, and the third to the timing of sawpit use. Two hypotheses were designed to investigate the domestic life of timber workers. The first related to evidence for habitation at sawpit sites and the second to the reuse and recycling of material culture due to the influence of isolation. This chapter discusses these five hypotheses and whether they are supported by archaeological evidence from the Canning Timber Concession.

Sawpit technology

Vines’ (1985: 29) work on sawmills in Victoria, suggested that timber processing technology changed and adapted in response to local conditions. The form of this adaptation was dependent upon a number of factors including economics, environment and timber type. I developed the hypothesis that an adaptation of sawpit technology would be seen, defined by local conditions and materials. Field
methods tested for this and the archaeological data suggests evidence for a local adaptation.

This adaptation relates to the depth of sawpits. There was considerable variation in design elements across the eight investigated sawpits, except in depth. Historical descriptions of sawpits suggest that they were regularly two metres deep, while the average depth of the investigated sawpits was approximately one metre. Slee and Shaw suggest that “…anyone who has dug a hole in Kalamunda will immediately see the uneconomic possibilities of digging a sawpit to cut up a tree” (1979: 8). As a long time resident of the study area I can attest to the extreme difficulties of digging a hole in the rock hard ground of the Darling Scarp. The local environment in which these sawpits were constructed and used has uniform vegetation and soil types. Slee and Shaw (1979: 8) also describe the heaping of earth on either side of the sawpit in order to raise the sides, allowing the digging of a shallower trench. This was seen at Sawpits SPP1b, SPP2a and SPP6a. Sawpit SPP5a had one side raised but this was attributed to its positioning across a slope and the necessity of raising one side in order to make it level with the other. Raised sides were not seen in all sawpits. I interpret sawpit shallowness, combined with other mitigating solutions such as raised sides, to comprise an adaptation to local conditions. The regularity of depth across all sawpits supports this interpretation, as does the labour involved in digging a sawpit in this area.
No uniformity was seen across the eight sawpits in any other design element. Length and width varied greatly between sawpits and based on the available evidence it is impossible to determine why there was such a large variation. I would suggest that length and width was determined for each pit as required. A long wide pit was needed for very large trees and a short slim pit for smaller trees. However, there was no archaeological evidence to support this. My interpretation is that a uniform length and width was not a feature of sawpit design in the Canning Timber Concession.

Based on historical records I developed the hypothesis that sawpit location would be dependent upon topography and the location of timber resources to be exploited. The evidence recovered during fieldwork supports this hypothesis. Based on data derived from a single field survey and the six sawpit sites, I suggest that sawpits were not distributed evenly throughout the forest, but were constructed on level ground based on the location of individual large jarrah trees. Each sawpit recorded was situated on ground with a slope of less than five degrees and immediately adjacent to a tree stump with a diameter greater than one point five metres. My interpretation is that the placement of sawpits in the Canning Timber Concession was not organised to capture the largest number of trees, but rather, to deal with the largest individual tree in an area. It could be argued that the labour required to construct a sawpit was less than that required to move a sawlog with a diameter in excess of two metres over a certain distance.
The historical records of the timing of sawpit use in the Canning Timber Concession suggested that it was first used in the area in the 1850s (Robertson 1956: 6-10) and may have ceased in 1891 when Keane brought improved timber-getting technology into the area (Slee and Shaw 1979: 44). However the exact timing of sawpit use was not known. I developed the hypothesis that sawpit use in the Canning Concession was restricted to the period between 1850 and 1891. No archaeological evidence was recovered at sawpit sites that allowed this hypothesis to be tested. Artefactual assemblages at sites were too impoverished to allow the dating of sites using the known age of artefacts. Site SPP4 was dated to the mid 1880’s but this artefact scatter cannot be definitively linked to the sawpit at site SPP3 (discussed later in this chapter). Consequently, the only evidence for the timing of the use of sawpit technology in the Canning Concession remains the ambiguous historical record.

In this study of sawpits I have used a synthesis of archaeological and historical data to develop the following model for sawpits in the Canning Timber Concession:

- Sawpit features display a local adaptation to the hardness of the ground. Consequently, sawpit depth will be approximately one metre and strategies such as raised sides will be used.
- Sawpit features will display variability in length, width and other construction elements such as buttressing.
• Sawpit features will be located on level ground, with an incline of less than five degrees.
• The location of sawpits will be related to individual large trees. This will be demonstrated with the sawpit located immediately adjacent to a tree stump at least one point five metres in diameter.

**Domestic aspects of sawpit sites**

Historical sources (Millett 1980; Police Records No. 129) suggest that timber workers and their families lived at some sawpit sites. To test for this I developed the hypothesis that sawpit sites will contain evidence of domestic activities, indicative of people living at those sites. Having located the sawpit sites, recorded the archaeological material and conducted my analysis I consider that the archaeological data does not support this hypothesis. Evidence for domestic activities at sawpit sites was recorded, but my analysis is unable to show that it represents evidence of habitation. Domestic evidence in the form of bottle glass was recorded at all sawpit sites with the exception of SPP3. Bone and metal were also recorded at sites SPP1 and SPP2. However, the number of domestic artefacts at each sawpit site was low, averaging only 14, except site SPP3 where none were recorded. Analysis of artefact distribution at sawpit sites suggests that they represent primary refuse and were discarded where they were used. Artefacts were recorded individually, or in small clusters representative of individual items and there is no clear rubbish discard area at any of the sawpit
sites. While the evidence suggests that domestic activities were taking place, it does not imply habitation.

The exception to this is site SPP4. This site is situated approximately 50m to the east of the sawpit at site SPP3 and it is possible to draw links between the two and suggest that site SPP4 possibly represents a camp site for workers using the sawpit at site SPP3. The two sites are close to each other geographically and if the 1880’s date for SPP4 is accepted, then it is contemporary with the use of pit-sawing in the area. I have found no records of people being in the area for reasons other than timber-getting, until the 1890’s when the Canning Mills settlement was developed. Despite this, people may have been in the forest for reasons other than timber getting.

The lack of domestic items at site SPP3 can perhaps be explained by the location of site SPP4. At all other sawpit sites examined a small number of domestic items were spread throughout the entire site. Domestic items were not recorded at SPP3, but were found in a discrete scatter 50m to the east. In this scatter, glass, ceramic and metal artefacts representing food and beverage storage and consumption are present. I interpreted SPP4 as representing the secondary refuse of a short term campsite. However, there is no real evidence that intrinsically links it to SPP3. There were no industrial artefacts in the assemblage such as saws, files, or other timber getting equipment, to provide evidence for timber workers being present at the site. One interpretation could
see the two sites as representing the industrial (SPP3) and domestic (SPP4) elements of a single timber camp. There is no reason not to expect that industrial and domestic areas wouldn’t be separated at camp sites, as they are at sawmill settlement sites (eg Davies 2002a; Smith 2003). However, there is still no direct archaeological evidence that links the two sites.

While some historical evidence suggests that some timber workers lived at sawpit sites, I have found no archaeological evidence for this at sawpit sites in the Canning Timber Concession. There is evidence at these sites for domestic activity, but not habitation.

Previous research by Davies (2001a), Vines (1985) and Smith (2003) suggests that the domestic life of timber workers was affected by isolation. Davies showed that the material culture of timber workers reflected this isolation through the re-use and recycling of items that are difficult to replace (1999: 258). However, their material culture also showed that timber workers were integrated into wider social networks through the presence of luxury goods (Davies 2002: 64-65). To test whether isolation affected timber workers in the Canning Concession I developed the hypothesis that material culture at sawpit sites would show evidence of both the reuse and recycling of artefacts, and improvisation and adaptation to the jarrah forest environment. Additionally however, I hypothesised that evidence would be seen for integration with the wider colonial society.
I found no evidence during fieldwork to support this hypothesis. No artefacts at sawpit sites provided any evidence that they had been modified for reuse, or recycled. However, the small number and fragmentary nature of artefacts at each sawpit site limited the chance of finding such evidence. The presence of the black glass artefact in the SPP4 assemblage demonstrated recycling at that site. Additionally, the SPP4 assemblage contained a Codd bottle manufactured by the Melbourne Glass Bottle Company and imported to Western Australia from Victoria. This demonstrates that the people who used this site were able to access wider trade networks. However, as previously discussed, site SPP4 cannot be shown to be the result of timber-getting activities.

**Conclusion**

In this chapter I have discussed the archaeological evidence recovered during a case study of six sawpit sites in the Canning Timber Concession. To achieve the aims of my research I had developed five hypotheses and tested them using this archaeological evidence. Of these, the archaeological evidence has supported the hypotheses relating to the technological adaptation of sawpits and their distribution in the forest. However, the evidence has not supported the hypotheses relating to the timing of sawpit use, habitation at sawpit sites, and the influence of isolation on timber workers.
Chapter Seven - Conclusion

This chapter will conclude my thesis. I will discuss whether the aims of my research have been achieved and the contribution of my research to archaeological knowledge. I will then discuss the validity of my methods and in particular if they were able to deal with the problem of vegetation obscuring ground visibility. Finally I will suggest avenues for future research of the timber industry in the Canning Timber Concession.

Contribution to archaeological knowledge

I began this research with the general aim of investigating the way sawpits were constructed and used within the forest. More specifically I aimed to investigate the industrial and social organisation of sawpit sites within the forest. I believe that the aims relating to the technology of sawpits have largely been achieved. The aims relating to the social organisation of sawpit sites have only been partially achieved due to limited evidence at the surveyed sites.

I have been able to show that timber workers adapted the traditional technology of pit-sawing to the local jarrah forest environment of the Canning Timber Concession. I have demonstrated that this adaptation was probably a response to the difficulty of digging sawpits in the hard ground of the Darling Scarp. I have also been able to show that sawpits were distributed in the forest in order to exploit individual timber resources in the form of single large trees, rather than to
exploit collected timber resources. Sawpits were thus not distributed evenly, but were located based on the position of resources. I have not been able to use archaeological evidence to achieve the aim of confirming the timing of sawpit use in the Canning Timber Concession. Evidence was insufficient to allow the dating of all sawpit sites.

The archaeological evidence I recorded would suggest that sawpit sites in the Canning Timber Concession were not inhabited by timber workers. While historical records suggest that some sawpit sites were inhabited by timber workers, there is no evidence to support this at these sites. Site SPP4 provides evidence for people camping or living in the forest but links between it and the SPP3 sawpit are only suggested not confirmed. Additionally, I must suggest that the lack of evidence may be the result of a number of other factors such as poor ground visibility or short term occupation at sites by timber workers. I would argue that while the aim of testing for habitation has been partially achieved more sawpit sites would need to be investigated to confirm it.

The lack of artefactual evidence at sawpit sites has limited the ability of my research to achieve the aim of determining the effects of isolation and integration on timber workers in the Canning Timber Concession. Both Davies (1999; 2001a; 2001b; 2002) and Smith (2003) used material culture to demonstrate the effect of isolation in their studies. The lack of material culture evidence at the Canning Timber Concession sawpit sites made it impossible to do the same in my
research. The material culture at site SPP4 suggested the recycling of material and demonstrated integration with a wider society, but again, this site could not be effectively linked with the SPP3 sawpit.

Finally, due to the limited amount of previous Australian research into the primary timber industry, I aimed to test the archaeological potential of sawpit sites. Based on my results I would suggest that sawpit sites have good potential for answering questions about industrial and technological processes. Using archaeological and historical data I have developed a model demonstrating that pit-sawing technology is not uniform but will be adapted to meet the needs of local environment and timber types. I have demonstrated that adaptation for the jarrah forest of the Canning Timber Concession. I would however suggest that sawpit sites have limited potential to answer questions about timber workers and their society. The lack of domestic artefactual evidence makes them a limited resource in this regard.

**Limits to research**

The inability of my research to achieve some of its aims is in part the result of limitations imposed by my research design. My research involved the surface survey of previously known sites in heavily vegetated jarrah forest. I will discuss two aspects of my research design in particular; my strategy to deal with ground visibility problems, and the limitations of surface survey.
My research design applied a strategy where a 40m² grid around each sawpit was field walked and sampled. This strategy was highly effective at a site like SPP1, where ground visibility was around 30% and the vegetation consisted of light scrub without a significant tree canopy overhead. However, it was almost useless at the forest sites of SPP3, SPP5, SPP6 and SPP7, where the heavy bush was simply too thick. Middle story vegetation such as *dryandra* and *aquafolia* also contributed to these difficulties as they made movement at SPP6 and SPP7 very difficult and further impeded visibility.

At sites SPP6 and SPP7 ground visibility was zero and only very large artefacts were recorded in vegetated areas. Small artefacts were only recorded on the fire tracks which ran through the sites. Conversely, at site SPP4 where ground visibility was approximately 80%, 294 artefacts were recorded. At sites SPP1 and SPP2, where ground visibility ranged from 10% up to 50%, 155 artefacts were recorded. At site SPP3 where visibility ranged from 2% to 10%, nine artefacts were recorded. It is unknown whether the small number of artefacts recorded at SPP3, SPP6 and SPP7 is attributable to visibility, or to a real lack of evidence. Terrenato and Ammerman (1996) demonstrated that ground visibility has a significant effect on surface survey, making it 27 times less likely to discover sites in heavily vegetated areas. This can be extrapolated to intra-site survey, where ground cover is so thick that the ground is completely obscured. Following Terrenato and Ammerman (1996), I analysed the recorded artefact numbers relative to ground visibility, to indicate the effect of site visibility on artefact
recovery during site survey. This analysis covered all sites except SPP4, which is a different site type and SPP5, where ground survey was not attempted.

The amount of visible ground at each site was estimated and recorded as a percentage. This was done at each site by myself and based on the amount of leaf litter, understory vegetation such as grass and shrubs, and vegetation density. Thus, I consider that the accuracy rating for ground visibility at each site is good and an analysis based on this is appropriate. Only sites SPP6 and SPP7 had uniform ground visibility across the entire area of the sites. Sites SPP1, SPP2 and SPP3 had changes in ground visibility across the sites. In this case, ground visibility is averaged across the entire site. Ground visibility for each site is shown in table thirteen.

<table>
<thead>
<tr>
<th>Site</th>
<th>Area surveyed</th>
<th>Ground visibility %</th>
<th>Total artefacts</th>
<th>Artefact / square metre</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPP1</td>
<td>1600 sq. m</td>
<td>40%</td>
<td>99</td>
<td>0.062</td>
</tr>
<tr>
<td>SPP2</td>
<td>1600 sq. m</td>
<td>25%</td>
<td>56</td>
<td>0.035</td>
</tr>
<tr>
<td>SPP3</td>
<td>1000 sq. m</td>
<td>10%</td>
<td>8</td>
<td>0.008</td>
</tr>
<tr>
<td>SPP3</td>
<td>600 sq. m</td>
<td>2%</td>
<td>2</td>
<td>0.003</td>
</tr>
<tr>
<td>SPP6</td>
<td>1600 sq. m</td>
<td>0%</td>
<td>1</td>
<td>0.000625</td>
</tr>
<tr>
<td>SPP7</td>
<td>1600 sq. m</td>
<td>0%</td>
<td>2</td>
<td>0.00125</td>
</tr>
</tbody>
</table>

Table thirteen. Artefacts recovered dependent on ground visibility

While this sample is probably too small to draw extreme conclusions, a correlation between ground visibility and the numbers of artefacts recorded can be drawn. A decrease in ground visibility is accompanied by a decrease in the number of artefacts recorded. Additionally at the sites with close to zero visibility
the only artefacts found in the vegetated areas were all large enough to obtrude through the thick undergrowth. This suggests two conclusions. First I suggest that the small numbers of artefacts recorded at sites with less than 10% visibility is in part, the result of ground visibility. Second, it can be suggested that artefact size is also an important factor. These findings could be tested by controlled burning of the ground cover at the recorded sites and then surveying to determine if more artefacts were hidden by the thick vegetation.

Surface survey is a strategy which has two obvious limitations. First, as Schiffer suggests surface survey only recovers artefacts above ground and misses any which may be located below the surface (1987:354). As a result recovered artefact assemblages may be impoverished and the potential to recover appropriate data is thus compromised. Surface survey also lacks the stratigraphic controls of excavation. The law of superposition cannot be applied to artefacts in order to determine a sequence of deposition. In some cases the sawpit sites contained artefacts in a surface context that were deposited in the last ten years, laying next to artefacts that were demonstrably contemporary with the period of sawpit use in the Canning Timber Concession. Additionally, the fact that artefacts were contemporary with the use of sawpits does not mean that they were deposited at the same time. Links between artefacts and the sawpit feature are thus only implied. In my research the decision to use surface survey was due to the lack of obvious excavation locations at sawpit sites. I believed that to excavate without a previous knowledge of sawpit site organisation would be a
redundant technique. Additionally, as I did not receive permission to collect artefacts from crown land, the outcomes of a strategy involving excavation would have been limited. Thus, despite the limitations of surface survey, I believed it to be the most appropriate strategy for a first investigation of sawpit sites.

**Future research possibilities**

In my research I was unable to achieve the aim of investigating the social and domestic lives of timber workers in the Canning Timber Concession. Further research would be needed to achieve this aim. I would suggest that an appropriate strategy to achieve this aim would be to follow the work of previous researchers and investigate the timber settlements of the Canning Timber Concession. A number of timber settlements have developed in the Canning Timber Concession since 1864, beginning with Mason’s Mill and including Canning Mills, Barton’s Mill, Carilla, Karragullen and Carinyah. These sites were inhabited by timber workers and often their families, and their investigation is warranted to answer questions about the social lives of these people.

These sites were not all contemporary. For example, Mason’s Mill which existed from 1864 to 1884 (Slee and Shaw 1979: 7-45), was relatively isolated and operated using archaic technologies. The settlement of Canning Mills, which did not commence until 1889 (Slee and Shaw 1979: 45-46), was connected by rail to other settlements in the area and used more modern timber-getting technologies. A comparative study of the two settlements could answer questions about the
impact of isolation, transport networks, and technology change on the timber industry in the Canning Timber Concession.
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