Mount Dutton Bay:

A 3D Coastal Landscape Analysis

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DEDICATION

This thesis is dedicated to the loving memory of Bryon Mitchell.

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ABSTRACT

Mount Dutton Bay, located on the southern Eyre Peninsula, is a spatial location that performed a vital role in South Australian colonial settlement strategies. This sheep station and port provided fresh water, marine and terrestrial resources and so was a vibrant coastal hub at the centre of a rural colonial trade network. Promulgating colonialist, commercial and industrial endeavours, this particular site also became the outlet for local social networks. Pastoralists and mariners of the 1870's capitalised on the sheltered waters and central location of this bay, and it became the site of a jetty responsible for the supply of a large region as well as the primary export point for that region. A woolshed was constructed in close association to this jetty connecting the maritime trade with the pastoral enterprises of the region.

Archaeology of this site has been confined to isolated maritime, and a single terrestrial study of built material culture. Previous work includes the analysis of an associated shipwreck and a study of the jetty's structural design as well as some site recordings made of the terrestrial features. While these previous works are useful as processual epistemologies, they have failed to engage with the broader spectrum of past meanings and ideas that motivated the development of this site.

Through the application of 3D Landscape Analysis, this research ventures outside the confines of separated schools of thought to consider multiple

aspects of the site holistically. Concurrently, remaining archaeological material culture is recorded through the virtual paradigm of photogrammetry techniques, making it accessible for future studies.

The research incorporates this new technology with the more traditional archaeological methods of pedestrian survey, total station, and aerial landscape photography. This research goes some way to shed light on the role of coastal sites in general, and more particularly the role of Mount Dutton Bay in local colonial settlement strategies, revealing overlapping landscapes of class, workspace and fear made visible through this study. It also demonstrates the strengths of 3D landscape analysis in the investigation and positioning of coastal sites within the purveys of historical archaeology.

DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Jarrad Kowlessar March 2017

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ABREVIATIONS AND ACRONYMS

AGL Above Ground Level

COLLADA Collaborative Design Activity

DEM Digital Elevation Model

DJI Dà-Jiāng Innovations

ESRI Environmental Systems Research Institute

GDA Geocentric Datum of Australia

GIS Geographical Information Systems

GPS Global Positioning Systematic

ISO International Standards Organisation

MCL Maritime Cultural Landscape

UNESCO The United Nations Educational, Scientific and Cultural Organisation.

3D Three Dimensional

CHAPTER 1: Mount Dutton Bay

1.0 Introduction

Figure 1.1: Map showing location of Mount Dutton Bay in relation to lower Eyre Peninsular in South Australia

Mount Dutton Bay is located about 300 kilometres west of Adelaide on the Eyre Peninsula, a component of the region collectively known as Coffin Bay. Indigenous Australians, the Nauo people, exploited this area for centuries for

its abundant shellfish, and the region also attracted early pre-colonial whalers and sealers. However, it is the following colonial settlement period that this thesis focuses on.

The first European exploration was by Charles Christian Dutton, who settled there in the 1840s (Sheffi 2006). Reputation of the area's fishing opportunities preceded South Australian colonisation making the region a target for colonists (Colvin 2011), and a fishing industry focussed on the abundant oyster beds.

The surrounding lands became pastoral sheep and cattle grazing territory, with wool a major product of the region (Khan 2006; Colvin 2011). The two separate industries, marine and land based, connected in 1875 when a woolshed was constructed on the coast of Mount Dutton Bay, becoming the major port connecting this region to the colony within a few years. Construction of the jetty began in 1880 and was completed by 1881. Built within a few metres of the woolshed, both were designed to be operated closely together with a railway connecting them. The jetty was used primarily for wool exports from the adjacent pastoral lands and also played a role in the fishing industry (Khan 2006; Colvin 2011).

The oyster population eventually ran low due to unsustainable fishing practices and the industry went into decline by 1920 (Sheffi 2006). By the 1930s, inland train rails made the jetty obsolete. Today the woolshed has

been converted into a museum and the jetty still stands, now converted for recreational use after a long period of closure and disrepair (Khan 2006). During the course of initial activity however, this coastal complex became the centre of a large community drawing from up to fifty miles around.

Situated at the union of maritime and terrestrial cultures, this site provides important insights into colonial and settler views towards coastal space. Despite this, only limited archaeological research has been conducted here, focused exclusively on maritime activities and neglecting the coastal connection to the terrestrial cultures that surround the bay (Khan 2006). The importance of recognising the unique coastal culture that bridges the divide between terrestrial and maritime domains has been identified in archaeology, giving rise to the application of landscape analysis approaches such as ‘coastal archaeology’ and the Maritime Cultural Landscapes (Ford 2011a, Ford 2011b; Westerdahl 2011).

This thesis investigates Mount Dutton Bay from a holistic, inclusive position that combines and complements traditional archaeological approaches to understand this site. This is done by creating a mixed data collection that allows the overlap and critique of several methodologies. Added to this is the application of a geographic information system (GIS) based digital geo-statistical analysis incorporating a comprehensive 3D landscape analysis. The resulting database enables interpretation to draw on data from all recording methods, open new avenues of investigation, and to enter the

current dialogue surrounding the separation of data and interpretation divides (Ashmore and Knapp 1999; Wüst et al. 2004; Forbes 2007; Frischer and Dakouri-Hild 2008).

1.1 Aims and Objectives

This thesis aims to explore the nature of colonial activity at this coastal hub by conducting a detailed landscape study which reconstructs the site in a digital three dimensional space. This study will integrate a variety of sources of data which can be viewed and understood in a holistic and intuitive way. This reconstruction will also form a permanent record of the site in its current condition. The outcome of this aim is to describe those activities that occurred at the site, and position them within the context of the larger scale colonial landscapes.

A further aim is to unify the material and historical records, exploring the attitudes towards coastal space that can be made visible through a holistic study of the materials at the site within the context of the surrounding landscape. Ultimately this research asks:

“What can a three-dimensional landscape analysis reveal about colonial attitudes towards coastal space?”

Throughout this research, ‘coastal space’ will describe any area, terrestrial or maritime, where human activity is conducted with a specific regard for transitioning between land and sea environments. In this way, coastal space may, in one resolution, span from fifty miles inland, for example where goods are packed and transported to the coast for export. At smaller scale, coastal space may describe areas where the view of the ocean is desired for a

residential location (Ford 2011a, Ford 2011b).

The colonial attitudes being addressed relate to those European colonists of the early South Australian colony who first began activities in the region in the 1840s and created the facilities being recorded at Mount Dutton Bay.

1.2 Thesis Outline

This chapter provides an introduction of Mount Dutton Bay and the historical significance of this important coastal complex. The research aims and major question is described, as well as a definition of those terms critical to this study.

Chapter two reviews the debates and discussions on landscape analysis, particularly within a coastal context, that are visible within the archaeological literature. This chapter also reviews different approaches to data integration and visualisation in the context of landscape and complex spatial analysis. Chapter two also provides a review of previous research conducted on coastal and maritime South Australian settings.

Chapter three provides a detailed historical account of Mount Dutton Bay and the surrounding Eyre Peninsula region. This addresses the existing written records and historical anecdotes that describe the events and attitudes of this space, as well as providing a historical narrative of the Eyre Peninsula. This chapter also introduces archaeological research conducted on similar, nearby pastoral stations on the Eyre Peninsula.

Chapter four describes the methodology employed in this research, explaining and justifying this particular approach to landscape analysis. This covers the collection of data, including ground based surveys and remote sensing from a remote piloted aircraft, as well as data processing techniques

such as photogrammetry and geostatistical surface interpolation. This chapter explains the analytical geostatistical operations conducted on the collected data to better understand the nature of the site. These include a visibility analysis, demonstrating the areas within sight of specific structures within the Mount Dutton Bay complex.

Chapter five presents the results of those methods employed through this research. These results are presented so as to demonstrate the visual nature of this multivocal, complex dataset. The data is presented in visual context of both the larger landscape, as well as the local site level terrain, and integrates historical maps of the region as well as satellite imagery of the contemporary landscape.

Chapter six discusses the results of this study and presents a description of the activities that occurred at the site, as well as an interpretation of the attitudes towards coastal space that are visible within the data. This chapter answers the research question as well as providing a review of the approach and makes recommendations for future research.

CHAPTER 2: Literature Review

2.0 Introduction

This chapter reviews spatial archaeology in a broad context exploring a brief history of its applications and debates before studying the deeper philosophical discussions of landscape approaches. With a view to Australian coastal archaeology, selected case studies demonstrate both the theoretical issues raised within the literature as well as the practical approaches employed to conduct such analyses. The chapter traces the central debate that divides more statistical and empirical approaches as well as those that seek to uncover human perspectives on past landscapes. Concluding with a review of modern, novel approaches to landscape analysis, the chapter focuses on ‘virtual archaeology’ and its potential to capture a broad range of landscape theoretical perspectives in a unified approach.

2.1 Background of Spatial and Landscape Archaeology

Traditionally the spatial characteristics of a site or landscape have been recognised as useful information for archaeologists, however, in early studies the information provided was limited only to that which was recorded in the field. This data was viewed as descriptive of human activity and space was viewed simply as a canvas upon which a material record of human activities was drawn (Wheatley and Gillings 2002). The space itself was seen to have played no real role in these activities other than providing boundaries and guiding economic opportunities. Spatial studies at a regional scale became a new method of archaeology termed ‘Landscape archaeology’ with specific interest in patterns of culture within the spatial distribution of archaeological materials (Fleming 2006; Hodder 1977a; Kimura 2006). These patterns were typically detected by simple visual inspection of archaeological materials plotted on a map, and interpreted with the theory of cultural diffusion as the driving force for the spread and patterning of culture (Hodder 1977a; Wheatley and Gillings 2002). The eventual recognition of patterns of culture occurring at these scales across large regions gave rise to the term ‘Cultural Landscape’ as a distinction from the natural landscape upon which it was placed (Ashmore and Knapp 1999).

However, a central debate to arise from landscape archaeology surrounded the method for identifying spatial patterns within the data (Fleming 2006; Hodder 1977a; Kimura 2006). Visual assessment became highly criticized for

its subjectivity and so a call was made for a more quantitative approach. From here the use of spatial analysis was introduced into the field of archaeology. This method used statistical analysis of spatial data to detect underlying trends and spatial patterns which may then be correlated more objectively to causal factors within the data (Hodder 1977a). This early spatial analysis looked at the identified areas of cultural grouping and tried to explain them by comparing them only with other identified areas of distinct cultures spread across the regional space and with simple environmental conditions such as resource availability. In this way human activity was explanined as a deterministic pattern with little or no consideration of the underlying attitudes that may have influenced human behaviours (Fleming 2006; Hodder 1977a; Wheatley and Gillings 2002).

2.2 Social Influences on Landscape Archaeology

The scope of landscape analysis was eventually expanded by a new paradigm of archaeological thinking which criticised earlier landscape studies as being too simplified in those factors considered to influence human relationships with space. This new perspective argued for space as an active force in driving human activity and culture. Where the previous outlook had focused on settlement patterns viewing human behaviour at regional scales of geographic determinism responsive only to environmental variables, the new outlook saw human behaviour at all levels as nuanced, personal, and in many ways, a spiritual experience (Ashmore and Knapp 1999; Forbes 2007).

This thinking is central to the concept that human culture shapes space, but space also shapes human culture (Westerdahl 1992). At the most simple level this may describe economic advantages of certain landscape features and human adaptation to make use of these resources, but at a larger scale, this school of thought delves much deeper into the human experience of landscape (Ashmore and Knapp 1999; Fleming 2006). This suggests that ‘landscape is an entity that exists by virtue of its being perceived, experienced and contextualised by people’ (Ashmore and Knapp 1999). With this in mind, archaeological inquiry was expanded beyond simply asking what human behaviour occurred on a landscape to asking deeper questions of the human experiences of these peoples and to developing a more nuanced understanding of the past (Ashmore and Knapp 1999; Fleming 2006; Tilley 1994, 2010).

2.2.1 Phenomenology

A seminal, yet controversial approach to arise from this new direction is known as phenomenology. A central assertion of phenomenology is that any interpretation of the past will ultimately be a construction of the present and that this inherent bias must be addressed in archaeological procedure so as to perceive the closest perspective of the past (Barrett and Ko 2009; Tilley 2010). Phenomenology sees the surveys and measurements of some geospatial approaches as being performed from the perspective of the outsider looking into a landscape and therefore unable to detect the perspectives of those who lived within the landscape of study (Fleming 2006; Tilley 1994, 2010). In this way, those individuals who occupied past landscapes did so from within the system and the landscape itself influenced them in subtle and numerous ways as part of their daily lives. These influences and relationships are argued to have occurred at the most fundamental and sensory level working all the way up to influencing larger patterns of behaviour.

Phenomenology attempts to capture data from the insider human experiences of the past through the physical experiences and mental impressions of the archaeologist's, interactions with the landscape (Fleming 2006; Tilley 1994, 2010). This is argued to include the perceptions of the countless subtleties of that landscape that impact human behaviour and attitudes therein. These subtleties might be the view of landscape features from particular vantage points, the smell on the air, the natural paths and

walkways taken as the landscape is traversed. These factors are argued to have impacted past peoples in the same or a similar way when they acted upon the landscape and as such are seen as equally valid data, useful to reconstructing the past (Tilley 1994, 2010).

The phenomenology approach has some considerable criticisms (Fleming 2006; Tilley 2010). Throughout the ensuing debates, the notion that all assessments of the past are interpretations and will never be a truly accurate depiction of the past has generally been accepted (Ashmore and Knapp 1999; Fleming 2006). Despite this, the phenomenological approach has been accused of overcompensating for this bias (Fleming 2006). It has been argued that phenomenology are subjective and imaginative interpretations that go too far beyond the evidence, and cannot be replicated by other interpreters or be verified in any way (Fleming 2006). Furthermore, this approach subjects the interpretation of landscapes to a similar bias to that for which it was developed to address in that the archaeologist carries an inherently different ‘outsider’ perspective to the original inhabitants, even when immersed in the landscape. As Forbes argued, ‘It is impossible to have an understanding of human's’ place in the world completely free of one’s own cultural setting’ (Forbes 2007:22).

Critics have generally conceded that the call for more holistic and nuanced sources of information to landscape interpretation is critical to deeper interpretations of the past but that these interpretations should still be

supported by evidence beyond personal experience and intuition (Barrett and Ko 2009; Fleming 2006; Forbes 2007). This debate is still ongoing, however it has already shifted the paradigm of landscape analysis that now aims to develop a nuanced cultural understanding of the landscape that captures the perspective of the human subjects that acted within the landscape, or acted to create the landscape (Forbes 2007; Tilley 1994).

2.2.2 Social Approaches to Landscape Archaeology

The new paradigm has seen an explosion of data sources considered for landscape analysis, transforming the field into an incredibly broad range of approaches and considerations, many multidisciplinary in nature (Ashmore and Knapp 1999; Westerdahl 2011). In a quest for the human perspective of past landscapes many archaeologists have turned to social geography, anthropology and ethnographic sources to guide interpretation of landscapes. This approach does not see the past as removed from the present but instead as part of a living process that is still ongoing (Forbes 2007). As such this approach considers contemporary ethnographic sources and perspectives to be the most accurate insider perspective on a landscape and to hold values, traditions and memory that can be accurately applied to interpretations of the past (Forbes 2007).

Following this thinking, Forbes (2007) undertook a detailed ethnographic

approach to landscape archaeology, immersing himself in the contemporary culture of a Greek landscape. This process revealed the insider perspective of both the culture and the landscape, demonstrating a detailed and faceted insight into the past landscape through the lens of the contemporary people who are the cultural descendants of the original occupants (Forbes 2007). Social sources however, are not limited to first hand ethnographic engagement and many archaeologists who share the central theory of Forbes' approach have found other social sources that add similar perspective (Ashmore 2004). For example historical and archival information and documentation can glimpse a similar insider perspective to a landscape. Historical sources can in this way be seen as social sources (Ashmore 2004).

2.3 Defining Landscapes and Themes

Within the broad scope of modern landscape analysis, the notion that the same landscape can be interpreted in different ways from different perspectives has caused the bulk of the fundamental debate. The debate has centred on the different perspectives of those archaeologists studying a landscape, but perspectives of difference will also exist between all the human actors regarding a landscape itself. The same area can hold different meaning to different groups and this difference of perspective might apply to groups separated in time or even groups occupying the same time (Ashmore 2004). Additionally, the same group or even an individual might hold many different meanings for the same space (Forbes 2007).

The question of holistic landscape analysis has opened the area of research to a torrent of factors and perspectives which each need specific research approaches (Ashmore and Knapp 1999; Ashmore 2004). With different perspectives, values and meanings for the same spaces, archaeologists have recognised that the concept of landscape must be better defined and extended to describe a range of themes and even categorise different types of landscapes (Anschuetz et al 2001; Ashmore and Knapp 1999; Ashmore 2004). Early in the debate, the notion of a natural landscape and a cultural landscape were well accepted concepts, but more recently archaeologists have started to identify other distinct conceptual landscapes.

In attempts to classify landscapes, the UNESCO World Heritage Convention

recognises cultural landscapes as heritage features described as the 'the combined works of nature and man'. The operational guidelines for the World Heritage Convention have defined cultural landscapes into three categories; 'Clearly Defined Landscapes', 'Organically Evolved Landscapes', and 'Associative Cultural Landscapes'. Clearly defined landscapes describe those landscapes that were intentionally designed. These are likely to be constructed for aesthetic reasons such as gardens or parklands. Organically evolved landscapes describe landscapes that have evolved over time through social, economic, or religious/spiritual human engagements. Organically evolved landscapes may be relict landscapes, in which case the process that formed and maintained the landscape has come to an end, yet the remains of the landscape are still visible. Alternatively the organically evolved landscape may be a continuous landscape that is part of a process which is still ongoing. The final category put forward by the UNESCO guidelines is the 'Associative Cultural Landscape', which describes the cultural values associated with the landscape's natural features. Associative cultural landscapes may be subtle, but represent a social/cultural relationship between humans and the land (Ashmore and Knapp 1999).

Although these categories and similar categories like them are functionally useful in defining a landscape, the nature and complexity of landscapes still far exceeds these simple definitions (Ashmore and Knapp 1999:9-19, Dimitriadis 2003:1-2). Forbes' (2007) work in Methana, Greece demonstrates an approach that treats one larger landscape as made up of many abstracted

landscapes which combine like layers to form the larger whole. Forbes breaks his study area into four different landscapes each to be analysed differently: the productive landscape, the historical landscape, the kinship landscape and the religious landscape. This work demonstrates the use of a holistic, multidisciplinary, yet modular and manageable approach to the complex task of landscape analysis. Such holistic approaches lead the way in modern landscape analysis conducted around the world (Ashmore 2004; Ashmore and Knapp 1999; Dimitriadis 2003; Forbes 2007).

This philosophy of overlapping landscapes has been used to characterise and describe landscapes associated with the colonial pastoral industry in New South Wales (Harrison 2004). Harrison describes the *cultural* landscapes of pastoralism as being defined by both the mental landscapes of the station workers as well as the social landscape generated through working and living within the pastoral space. Harrison further describes the union between the environment and the mindsets of the early pastoralist as follows:

> The seasons, topography, vegetation and climate form the complex context within which pastoral practices were honed and localised in each region. The round of pastoral labour in turn affected the ways in which pastoral workers and their families interacted with and came to know and understand the landscape in which they existed. There is a subtle interplay here between the physical landscape and the mental

landscapes of former pastoral labourers (Harrison 2004:10).

These considerations demonstrate the complex nature of landscape analysis when a deeper understanding of past human behaviour and experience is researched. This work shows the connection between the pursuit of resources and behaviours best modelled by processual approaches and those deeper and more physiological influences on past activities.

2.4 Coastal Archaeology and Maritime Cultural Landscapes

The discipline of maritime archaeology has predominantly focused on underwater sites that are isolated and separated from other material culture, although the notion of networks and seascapes has added a larger spatial relevance to some studies (Ford 2011b), extending more recently to the recognition of terrestrially based maritime culture. Traditionally, coastal archaeology looked at cultural material divided by the waterline, holding three major environments for cultural material: terrestrial, intertidal, and submerged. However, by the unification of approaches to view these separate elements as a single interconnected site, maritime archaeology took its first foray into landscape archaeology (Ford 2011a; Ash 2007). This has been argued as arising from the necessity to do away with an artificial divide that relates more to the history of the development of archaeology as a discipline than it does to the human cultures being studied (Ford 2011a, Ford 2011b; Westerdahl 2011).

It is fair to say that coastal archaeology presents some specific circumstances that set it aside from other settings, and as such, requires distinct approaches and theories to be properly studied (Ford 2011a). The coast itself can be viewed as a border, but also as a bridge, both separating and connecting terrestrial and marine activities. The terrestrial culture of coastal behaviours can be seen in many cases as being maritime in nature, especially in the case of coastal settlements which often feature ports,

harbours, shell middens or other materials that describe interaction with the sea.

Coastal communities have distinct maritime cultures on which coastal archaeology focuses (Ford 2011a). This requires an understanding of the limits of the coast's influence on both terrestrial and maritime culture. A coastal archaeological study must make a distinction on how far the terrestrial maritime culture reaches inland, and similarly how far it reaches out to sea, before human activity can be considered in a purely maritime context. Ford (2011a:764) argues that the definition of coast is site specific and a distinction that should be made as part of an individual study and research questions. This introduces the central component of a coastal study, identifying the distinct cultures and coastal identities of past coastal peoples and understanding how these people viewed the coast and its natural landscapes and resources (Ford 2011a).

The concept of the Maritime Cultural Landscape (MCL) arose from the issues raised by coastal archaeology, most notably the need for holistic interpretations of maritime cultural remnants on both land and underwater. Westerdahl first put forward the concept of the MCL in 1992, basing this concept on cognitive landscape theory. Westerdahl defines cognitive landscape as denoting '… the mapping and imprinting of the functional aspects of the surroundings in the human mind. Man in landscape, landscape in man' (1992:5). It is clear that the resulting MCL approach aims

at developing deeply human perspectives on coastal cultures and maritime values (Ford 2011b). The MCL approach makes specific aim to unite the material and the immaterial with a vast array of data sources which include both physical artefacts and social sources, such as interviews with local people and detailed historical review of traditions and local culture. Westerdahl (1992) identifies five major categories for the data sources useful to an MCL study: shipwrecks, land remains, traditions of usage, natural topography, and place names. These categories demonstrate the fundamental framework described by a MCL approach and its unified view of human activity on the coast and the sea as a connected system (Ash 2007; Ford 2011b; Westerdahl 1992).

The MCL approach has been well received and implemented in coastal studies but is still being negotiated and further developed by archaeologists (Ford 2011b; Stewart 2011), and internal debate occurs on exactly how to implement its vision. The acceptance of a landscape being best described by a broad approach with multi-vocal data generated by multidisciplinary approaches has created a challenging task for archaeologists attempting to holistically capture all available information. The resulting studies are often descriptive compilations of information that lack archaeological interpretation or exceed the information provided in the data sources (Stewart 2011). Further, the resulting descriptions of the landscape must fall short of the true nature of the sites because data will be missing from historic and material records and the vast quantity of sources that could be considered relevant to

a completely *holistic* study (Ford 2011b).

Westerdahl (2011) also draws attention to the nature of landscapes, and the tendency for multiple 'cultural landscapes' to exist within the same physical space requiring specific attention within the MCL approach. In this regard *holistic* can only be seen to be holistic in the data sources accessed to answer a specific avenue of inquiry or model a specific cultural perspective.

The Maritime Cultural Landscape approach and associated debates have drawn attention to the multifaceted nature of culture at these points of coastal intersection. The approach highlights the importance of multivocal data which must be analysed from a range of perspectives to capture the many layers of significance and culture in past human behaviour at such sites. This has been similarly noted by terrestrial landscape approaches but is particularly relevant for coastal settings which intersect maritime and terrestrial cultures creating a unique culture at their union.

2.5 South Australian Colonial Maritime Landscapes

Studies of the specific maritime culture of South Australia's colonial frontier are limited, and Khan's 2006 research of South Australian Jetties, is arguably considered the broadest focused study on South Australian colonial maritime infrastructure. His approach to this research applies site formation theory, which uses environmental and economic factors drawn from the regional historical narrative to explain the formation and transformation of a number of jetties around the South Australia's coast (Khan 2006:2). Throughout his study Khan was able to demonstrate that the construction of jetties and wharfs followed the expansion patterns of settlement activity prominent during the 1850's and again in 1880's. This is associated with the need for coastal transportation to these areas due to the absences of road or rail networks.

Khan's analysis shows the relationship between economic growth and jetty construction and conversely the relationship between jetty abandonment and economic depression (Khan 2006:98). Khan's findings could be fairly described as 'geographic determinism', as he utilised the rich historical records describing South Australia's colonial history as a means for statistical analysis of large-scale economic and environmental factors that fall outside of the perspective of individual intentionality (Khan 2006:27).

Khan's conclusions only touch on the complexities of the maritime culture of South Australia within this period. There remains the need for further more in-

depth understandings of maritime culture in South Australian colonial frontiers capable of incorporating more diverse human interactions.

Another prominent South Australian study in this area was conducted by Ash (2007), who researched the maritime cultural landscape of Port Willunga. Ash used a variety of sources of information which were incorporated into a MCL framework. The results of this study were able to identify local cultural values, both social and economic, to give human social perspectives on the landscape, and unify the information available from separated sources. This research addressed a far more localised culture than Khan's and as a result was able to provide very human perspectives on maritime behaviour. These two studies address the multiple resolutions which South Australian maritime culture occurred. Whilst at a regional scale geographical determinism may provide the best description of Maritime Behaviour, for a specific community much more social approaches are required to uncover the nuanced cultural behaviours at the site.

2.6 3D Archaeology Visualisation

Landscape analysis has called for approaches that are holistic, multidisciplinary, and model the landscape in a way that captures the human perspective as well as the larger patterns of activity. The need for an analyst to experience perspectives beyond abstracted data has led to sensual and experiential methodologies in landscape archaeology. Recently new ways of visualising archaeological data have been used to achieve a similar goal to such experiential methodologies yet still hold empirically measured data (Frischer and Dakouri-Hild 2008; Wüst et al. 2004).

Archaeological use of modern advances in data visualisation and the entire paradigm of experiential interaction with digital data has been termed ‘virtual archaeology’ (Frischer and Dakouri-Hild 2008). Virtual archaeology has been primarily used a means of dissemination of the results of archaeological study but increasingly it is used for archaeological analysis and interpretation. Visualisation of data has been identified as holding a number of advantages to archaeological analysis (Frischer and Dakouri-Hild 2008). Visualisation can facilitate the cognition of large amounts of data, from one or more sources as a single experience, perceive emergent properties within the data, understand relationships between features at different scales, and help formulate hypothesis (Bourdier et al 2015; Frischer and Dakouri-Hild 2008; Hermon 2008).

The application of visualisation techniques to landscape analysis has made

use of these features but extends visualisation principles into three dimensional data in a pursuit of a more engaging virtual experience. Such an experience aims to reveal how a human subject engages with space, by considering what features of an environment are visible from different human vantage points, what pathways will be taken as a human traverses the environment. Spencer (2007:98-99, cited in Frischer and Dakouri-Hild 2008) demonstrates this point in discussion on a phenomenological study of ancient Rome:

“Physically, one looks down from a building or a hill, up from a valley, off into the distance or up to high stories from street level. Such angles of gaze, and the perceptual and cognitive possibilities that they open up, inevitably generate and respond to key sites in an urban topography”

This approach to spatial analysis has been identified for application to analyse ancient Mayan city at the World Heritage Site of Copan in Honduras (Richards-Rissetto et al. 2012). The ancient ruins were modelled and represented in a huge scale three-dimensional Geographic Information System (GIS) which forms part of a project titled MayaArch3D. This virtual system models the local topography as well as the built structures in a single system which is now used to experiment with new ways to engage with this data for archaeological inquiry. Richards-Rissetto et al. (2012) identified a principle of communications research termed ‘telepresence’ to describe the advantage of virtual reconstruction to archaeology. Whilst presence is

defined as the sense of being in an environment, telepresence is defined as the experience of presence in an environment by means of a communication medium (Steuer 1992).

Tilley's (1994, 2010) phenomenology approach has made clear the importance of presence in understanding human experience (both past and present), virtual archaeology may now be able to allow similar experiential methodology to be applied directly to archaeological data (Frischer and Dakouri-Hild 2008). Such a digital phenomenology may work to unify approaches both empirical and experiential and to allow a more comprehensive archaeological engagement of large multi-vocal data sets.

The application of virtual archaeology and three dimensional landscape reconstruction can hold advantage beyond simulating the archaeological material present at a site in its current condition with some applications reconstructing past environments no longer accessible. Ch'ang et al. (2004) demonstrate the reconstruction of a Mesolithic landscape which dates to 10,000 – 7,000 B.P. This reconstruction was based on geo-seismic data gathered in the North Sea. This work demonstrates the ability to experience data in a way which describes the information it holds in a far more understandable way. The use of a virtual reality system and adding virtual features such as flora and fauna as well as reconstructed cultural materials allows principles of experiential methodologies to be applied to data which would otherwise be impossible to interpret in this way. This demonstrates a

further advantage to representing data in this way: hypothesis testing. Archaeological interpretations that move beyond a direct representation of data can be modelled and experienced which allow further evaluation and analysis.

Wittur (2013:53-77) reviews a project which demonstrates such experimental speculative modelling. Work done in Casa del Centenario in Pompeii which virtually reconstructed some building within the ancient Roman city. The results allow a virtual experience of what the buildings may have been like allowing archaeologists to assess their hypothesis visually. The speculative modelling exhibited here is, however, based on architectural styles appropriate to the age and the material structures that remain. Despite the ethical debate surrounding these individual representations, the advantage of being able to experience an environment where experimentation and interpretation can be added to sensual engagement is made clear.

2.7 Conclusion

It can be seen that within landscape archaeology a dichotomy exists between theoretical approaches which seek both empirical spatial information and nuanced understandings of past human attitudes and relationships towards space. To emerge from this debate is the value of holistic approaches which unify the many sources of information relevant to landscape. The use of visualisation and virtual archaeology has been identified as having the potential to accommodate vast multi-vocal data sets and allow interrogation and interpretation at a scale which can reveal both large scale patterns as well as nuanced details of human engagement with landscape.

The strength of this approach for multi-faceted coastal sites in general, and Mount Dutton Bay in particular, is reinforced in the following chapter which presents the historical background research of this complex site.

CHAPTER 3: Historical Background

3.0 Introduction

The previous chapter contextualised and identified the rationale for this research based on a critical review of previous relevant literature. More than a blank canvas upon which events occurred, Mount Dutton Bay, as a coastal location, was identified as a multiple cultural landscape comprising terrestrial, intertidal and submerged portions, which all exist within the same physical space (Westerdahl 1992; 2011). As such, added to previous theories of colonial settlement activity based on geographic determinism, was the cultural behaviour of individual and group intentionality (Khan 2006). To facilitate the cognition and dissemination of the large amounts of data this generates from these multiple sources, the use of a virtual archaeology (Frischer and Dakouri-Hild 2008) was discussed which is able to incorporate the computer aided modelling of relationships between the site topography and built structures (Spencer 2007; Bourdier et al 2015).

Chapter three now continues the themes identified with a discussion of the historical activities that are recorded to have taken place at Mount Dutton Bay, determining the extent to which this coastal site operates as a border between land and sea, or alternatively facilitates a bridging effect that stretches between and connects them both.

To set the scene, the primary historical context of the Mount Dutton Bay landscape as a frontier setting for the newly established South Australian colony under the Systematic Colonisation Scheme, designed to encourage selected colonials into the state, is presented. This context covers a range of themes and historical narratives which impact each other, and includes the colourful characters that have emerged from historical research regarding the local fishing industry, pastoralism and the interactions between the Indigenous inhabitants and the European colonists. All of these factors influence the negotiation of space in both maritime and terrestrial areas, and indeed, the spaces in between, encouraged by the prospect of economic opportunity found in both the terrain and natural resources available thereupon. The following historical background is an important precursor to understanding the complexities of Mount Dutton Bay, as each stage and separate pursuit inevitably influences and interweaves each other, in the multicultural human tapestry that was colonial Mount Dutton Bay.

3.1 Maritime Industries: Fishing, Whaling, Sealing and Oystering

The first recorded European observation of Coffin Bay was by Matthew Flinders in 1802. Flinders' ventures along the South Australian coast were closely followed by American whalers and sealers who are recorded as having camped on Kangaroo Island as early as 1803, less than a year after Flinders' original discovery of the island (Cumpston 1986). This marked the beginning of a period of highly exploitative fishing, sealing and whaling practices all across the South Australian Bay which penetrated into the resource rich waters of Coffin Bay.

Remains of the whalers' shore based occupations are seen in huts, and abandoned try-works. The tip of Coffin Bay at Point Sir Isaac is recorded to have a shallow well, dug by whalers (Casanova 1992:12). This is clear indication that Coffin Bay was as much explored and exploited by whalers, and likely also sealers during this period.

The reputation of these whalers and sealers was poor with documented stories of violence, exploitation, kidnapping and even murder of the Indigenous people spread all the way along the Great Australian Bight (Cumpston 1986:105; Casanova 1992:9; Pope 1989:21 Wallace-Carter 1987:6).

Records of the activities of the whalers and sealers in this time are intermittent and imprecise. However, the activities of this time may be responsible for the establishment of many of the first lightering points, landing sites, wells and water holes along the South Australian coast. It is also likely that general knowledge of the coast that persisted later throughout occupation and colonisation may have been generated at this time. As Casanova (1992:11) notes, the remains of shore based whaling activities such as huts, try-works and other material artefacts would likely have had continual patterns of use, abandonment and later reuse, by the same or entirely new parties. One example of this is the reuse of abandoned try-pots by later settlers as troughs or storage bins (Casanova 1992:11).

3.1.1 Oyster Gathering

South Australia was officially settled by the European colonists in 1836. This colonisation process was heavily based on the South Australian Company, a large enterprise with began its operation in South Australia on Kangaroo Island. The objective of this company was the settlement of South Australia and the enterprise endeavoured to capitalise on this settlement through involvement in the primary industries of the colony (Ewens 1952; Shefi 2006). One foremost objective of the company was construction and control of small decked vessels which would serve to connect the separate settlements and capitalise on the region's ample fishing opportunities (Ewens 1952). The

construction and investment of cutters, small single masted vessels which could be operated by as few as two men if needed, arose to suit the South Australian coasts. Agile vessels well suited to the both light and strong winds made cutters a suitable choice for the fishing industry in South Australia (Ewens 1952; Shefi 2006).

The flourishing fishing industry of the new colony soon reached into the waters of the Eyre Peninsula. Port Lincoln was settled in 1839 first by Captain Henry Hawson and his family who were quickly followed by 150 other settlers within a few days of their arrival (Casanova 1992:18; Baillie 1978:19). Coffin Bay was soon explored by oyster fishers who discovered the plentiful native oyster beds therein. These same waters, teaming with fish, became a centre of the industry (Wallace-Carter 1987:36). A small township arose to house the families and possessions of the fishers of the Coffin Bay inlets' complex landlocked waters. The town, at Kellidie Bay consisted of not more than a collection of small huts was named Oyster Town. Ships would anchor here to make use of the town as shelter and accommodation whilst working the day dredging oysters and catching fish. The fishing operations operated throughout Coffin Bay but most heavily in Kellidie Bay and Mount Dutton Bay (Wallace-Carter 1987:44). Oysters were dredged from their native beds by dredges operated from cutters. The oysters would be cleaned and stored in the shallow waters of Oyster Town before being transported to Port Lincoln for final transportation to Adelaide (Shefi 2006).

3.2 Terrestrial Industries : Early Pastoralism and Guano Mining

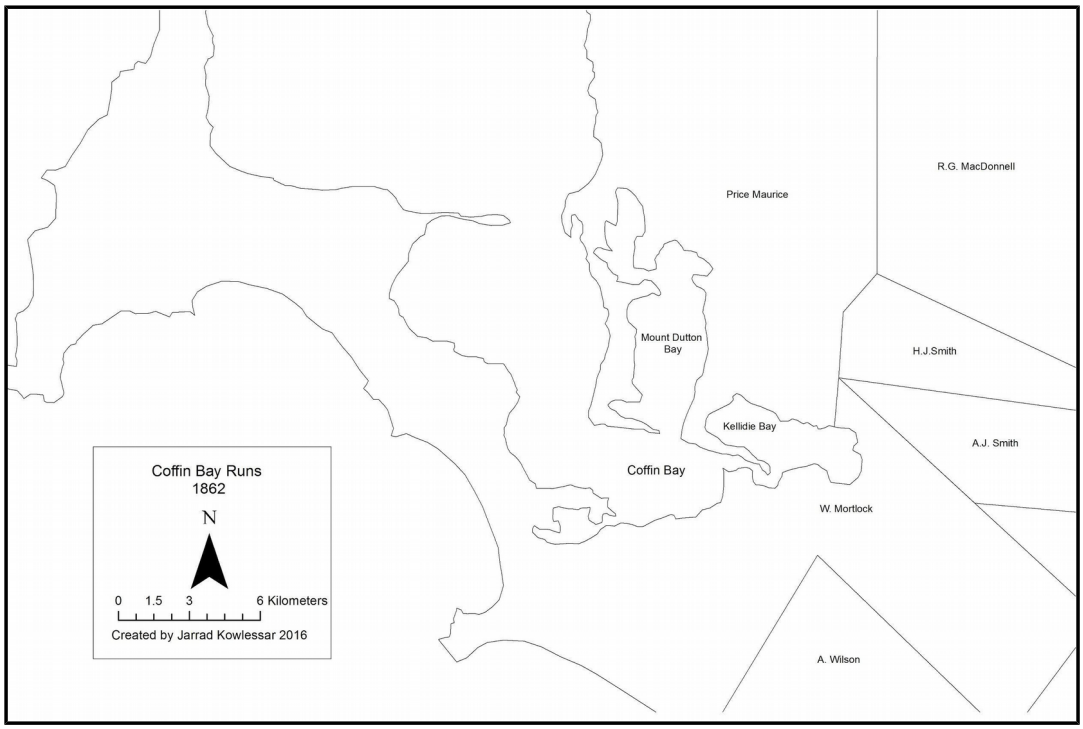

Figure 3.1: Approximate location of Coffin Bay runs of 1862 determined from historical sources.

The systematic colonisation scheme devised by Edward Gibbon Wakefield was the founding methodology of the South Australian colony and saw land sold in England with the funds raised used to import English labourers into the colony (Shultz 2015). This model required land be properly surveyed before its sale, presenting a major task for the early colonists (Harrison 1862).

During the task of selecting a site for the capital of South Australia, Colonel Light paid consideration to the Port Lincoln area. Whilst the region had attractive prospects for some, it was un-surveyed land and as such had no

means of purchase. When the region's first pastoralist Henry Hawson and his family first came to the area later known as Port Lincoln in 1839, much of the inner section of the Eyre Peninsula was still unexplored by the colonists and as such un-surveyed.

In the same year as settlement at Port Lincoln, Henry Hawson and Charles Christian Dutton, along with some other parties, explored the country inland from Port Lincoln and towards the west coast of the peninsula. At this time they discovered Mount Dutton and passed along the shores of Coffin Bay.

With the vast area of the Eyre Peninsula un-surveyed and therefore without any means for land to be purchased, occupational leases were offered to colonists with pastoral ambitions for this land (Danvers Architects 1987). Available from 1842, these occupational leases only entitled leaseholders temporary use of the land to be renewed annually for a price based on the number of horses, sheep and cattle to be placed on the land, plus the area of the land to be leased (The South Australian Government Gazette 1842). These land leases were referred to as runs which were unfenced land stocked with horses, sheep or cattle. The availability of these licences created a period of frontier exploration by ambitious pastoralists.

This period saw the negotiation and establishment of many boundaries, roads, tracks and facilities which in some cases remained for fifty years (Casanova 1992). Runs of this time were often unfenced, and as such

operated with a flock of sheep under the constant watch of a shepherd. Small huts and houses were established as dwellings for these shepherds (Casanova 1992; Danvers Architects 1987).

3.2.1 Mount Dutton Bay and Lake Wangary

Price Maurice, an inspiring pastoralist arrived in Australia in 1840 at the age of twenty two. Price Maurice was very successful in his early pastoral endeavours, turning profit from a number of leases around South Australia including runs at Manoora, Booleroo district and Lake Bonney district on the River Murray. Maurice took great advantage of the occupational leases turning profit from these un-surveyed and un-purchased lands (Cockburn 1927:1:54). Maurice eventually turned his attention to the Eyre Peninsula with the first lease falling to his control in 1851. Maurice acquired the lease held by John Fredrick Haigh and William Ranson Mortlock (Cockburn 1927; Casanova 1992:26) who had sold him their stock and run with all improvements for a ludicrously cheap price having been brought to despair by the lifestyle of the frontier pastoralist (Cockburn 1927:2:231; Casanova 1992:26). Maurice continued to acquire runs all along the west coast of the Eyre Peninsula including runs at Lake Hamilton, Warrow and Bramfield. Maurice acquired and consolidated runs that had been established by the first generation of frontier pastoral pioneers in the region. This first generation of pastoralists faced a great many challenges including the dangers and

damages caused by conflicts with the Indigenous people of the Eyre Peninsula, the sickness of coastal disease and the damages of drought. By 1858 Maurice had capitalised on the failing of previous pastoral enterprise consolidating a legendary run which reached from Coffin Bay all the way to Lake Hamilton. Maurices many leases include lease 73 which he acquired in 1858 and includes the entire shoreline of Mount Dutton Bay.

As the resumptions continued to encroach on the runs which were held under pastoral leases, many pastoralists began purchasing land to continue their enterprise. During this time Price Maurice purchased principle sections of the now declared hundreds of Warrow and Lake Wangary. By 1875 the lease 73 was totally divided and sold, however Maurice had managed to purchase and therefore retain use of some key sections of the former run. One such section was section 231 on the shore of Mount Dutton Bay (Casanova 1992).

3.3 Interstitial Spaces: Bridging the Divides

Figure 3.2: Cliff Morgan leading 'Speedo' on the Dutton jetty c1940 woolshed@duttonbay.com

Section 231 was a very astute buy for Price Maurice as this property became the interface with the first and only jetty servicing this area, built five years after this fortuitous purchase. The Jetty was government built and plans for its construction began in 1880 only a year before its completion (Puckridge 2016). Upon his initial purchase of the property in 1875 Maurice had a sizeable woolshed built on Section 231, which was of great local significance.

> "With its size and appointments, the Dutton Bay shed was a local wonder incorporating all the latest ideas then known, stone built and iron roofed, and sited within a stone's throw of the jetty head" (Casanova 1992:152).

Before the jetty, exports were made from a number of coastal points including

Mount Dutton Bay, Farm Beach and Little Douglas. Lightering points at Mount Dutton Bay before the jetty are unclear however landings sights along the east coast of the bay are believed by some to have been the accessed by dingy ferrying goods to and from ketches in the bay.

The jetty itself was a major development for the region and was used to import supplies to the region including farm supplies and groceries. The Jetty was also used as a major export point for the produce of the region such as grain, wool, hide and sheepskin. These exports would be shipped to Port Lincoln or straight to Port Adelaide. Prior to the opening of a railway in 1907 the jetty was accessed by such far away districts as Mt. Hope, Cummins, Edillilie and Kapinnie and even beyond (Puckridge 2016; Casanova 1992). The jetty was also used by fishing and oystering boats with the fortnightly transport of catches taken to Port Lincoln via wagons and later trucks loaded at the jetty (Wallace-Carter 1987; Puckridge 2016). The Jetty, which as of its original construction was a length of 82 metres and provided a 1.3 metre depth ad low tide was extended in 1911-1912 to a length was eventually extended to 207 metres though this extension only provided an additional 0.2 metre depth (Khan 2006:47; Puckridge 2016). Ketches continued to access the jetty up until the 1940's when the jetty entered a decline typical of South Australian jetties and piers made redundant by automotive transport (Khan 2006)

Between the jetty and the woolshed Mount Dutton Bay was a centre of both

professional and social activity. Farmers from inland farms camped in tents at the bay after a harvest. Indeed, a local opportunist, Mrs John Myers ran a small shop and tea room from a room, said to be grafted onto the shearers quarters cottage (Casanova 1992:170). The woolshed itself was also used for local functions and dances before the local area had any other suitable hall existed in the area (Puckridge 2016; Casanova 1992). In 1900 an Anglican church opened near to Warrow and a Methodist church opened overlooking Mount Dutton Bay.

3.3.1 Coastal Disease and Guano

The coastal situation of Mount Dutton Bay did more than bridge the divides of land and sea industries with its joint access to the natural resources of both, its jetty crossing access divides, providing extended transport of goods and people in and out, and its new woolshed bridging social divides. Added to this was the unique position of the local islands, between maritime and terrestrial, attracting coastal seabirds and creating a whole new industry that can be categorised as maritime, but was equally valuable to pastoralists. The value and use of Coffin Bay to pastoral industries was not limited only to trade, a further maritime activity of pastoralists can be seen in their pursuit of guano, both to fertilise crops and to combat coastal disease. Coastal disease is a mineral deficiency which affected the sheep grazing these areas which became another of the many challenges which could claim sheep from a flock and cause great harm to a business.

Guano, the long term deposits of seabirds was a well known fertiliser rich in phosphates and other such nutrients which were miraculous for plant growth and also seen as a possible preventive or treatment for coastal disease. Guano was readily available on the islands in Coffin Bay and off the coast of the Eyre Peninsula. Around 1849 Tolmer is said to have publicly commented on the large quantities of guano on islands at Mount Dutton Bay (Casanova 1992:41). The mining of guano from the bay islands, Brothers and Rabbit were major sites for guano mining activities, and eventually the islands were leased by pastoralists seeking to capitalise on their resources.

Licences to mine guano at Coffin Bay were issued from Port Lincoln but eventually land leases were available for the islands. In 1884 Mortlock, who at the time owned the Coffin Bay run along the peninsula to the south of the bay, leased Brothers Island and had a system which allowed customers to pay to visit the island and raise all the guano they wanted whilst there. Another local, Sept Puckridge, cooperated by delivering it in his cutter to Dutton Bay or other chosen lightering point for a fee (Casanova 1992:42). Other islands in the bay were also leased for mining. As super-phosphates began to be manufactured in factories and sold to farmers, local guano still retained its reputation as a superior fertiliser and cure for coastal disease. In the 1930s guano was still in use and locals were selling guano collected from the small island near to the woolshed at Mount Dutton Bay. This guano was made to order and collected from the Mount Dutton Bay jetty (Casanova 1992:43).

3.3.2 Frontier Considerations: Interactions with the Indigenous Nauo People

Mount Dutton Bay, as a frontier space where the early colonists and local Indigenous people first became aware of each other's conflicting ideas and methods of the use of this coastal space, presents yet another bridging, or liminal space that required complicated negotiations that often changed the courses of lives, and prompted cultural adaptations to fit the changing circumstances. Indeed, the course of interaction between the European colonists in Port Lincoln and the Indigenous Nauo people was turbulent and ultimately extremely violent, with a number of phases that tell the progressive story of this horrific chapter.

Initial interaction with the colonists at Port Lincoln fit into Pope's (1989) description of a phase of assimilation and accommodation. Interactions were peaceful and a number of Indigenous people made semi permanent settlement on the fringes of Port Lincoln (Pope 1989:25). As many as twenty Indigenous people were regularly employed around the town and were considered by some employers as highly reliable labourers (Pope 1989:32). However, within a few months of the colonists arrival there was an immediate decline in kangaroo and wallaby populations and plant based food resources were similarly reduced by the grazing of sheep so prominent across the peninsula (Pope 1989:93). The damage to the Indigenous food sources put a great deal of stress on their population and this ultimately stressed their relations with the colonists.

> Within a very few years of contact, Aborigines realised that the newcomers were threats to the very survival of their society and culture. Alienation of the land was at the heart of this realisation. The most immediate effect of European takeover of Aboriginal land was the destruction of food sources, loss of control over their land, despite the commonly held white view that they had provided better alternatives (Pope 1989:79).

The Indigenous people turned to the colonists for food or were left with no choice but to kill some of the sheep that now thrived in the stead of the traditional food sources. This resulted in clashes with shepherds, especially those who pushed the frontier of the colonists pastoral industry (Pope 1989:93). In 1840 one such dispute saw violence break out on one of Hawson's runs north of Port Lincoln. The exact events of this incident are unclear with many versions recorded, however the common narrative describe a group of Aboriginal people coming to food stores on Hawson's Rur and requesting food from Hawson's son, who at the age of ten was the only person tending the facility at the time. Whilst the boy gave them some food he did not commit to their full demands and eventually sealed the store room and threatened them with a gun and resulting violence saw the boy killed with a spear (Casanova 1992:19; Cockburn 1927:2:153; Pope 1989:93).

The death of Hawson's son became just one of many such incidents and shepherds, some of whom had previously embraced the Indigenous people, thankful for their company in otherwise isolation, became fearful and

resistant. Violent incidents increased resulting in the murder of both Europeans and Indigenous people. Shepherds and pastoralists began to shoot at Aboriginal people on sight when they saw them anywhere near their property. Station overseers and shepherds prepared to use violence were preferences by employers now paranoid of raids on their property (Pope 1989). This violence increased and at its most horrific saw station owners displaying the bodies of killed Aboriginals as a warning to others and even resorting to dismemberment to increase intimidation (Pope 1989:81). By 1842 these separate sporadic raids on flocks and food stores gave way to a systematic and unified resistance to European invasion and encroachment.

Port Lincoln was the focus of this resistance and over the following two years it resulted in the ruin of many pastoral business and nearly the total abandonment of the town (Foster and Nettelbeck 2012:45; Pope 1989:93). Once such pastoralist to quit during this time was Charles William Dutton. Dutton's station was the furthest distance from Port Lincoln and had become a target of raids. Dutton decided to travel with a small party and walk his stock overland to Adelaide. His party was not heard from for three months after his departure and eventual investigation found the lost stock and what was believed to be evidence of the party's death at the hands of Aboriginals (Pope 1989; Cockburn 1927:1:206). In response to this violence Lieutenant Francis James Hugonin was appointed to lead fifteen men of the 96th Regiment to the protection of the settlement of Port Lincoln.

Hugonin set out almost immediately on an expedition to capture and make an example of a group of Aboriginals responsible for a recent raid. This expedition is accounted as being less interested in finding those responsible as it was spreading fear through the Indigenous population. A large camp was accosted with people taken prisoner and some killed though it transpired that none were involved in the particular raid this expedition was seeking retribution for. Two more expeditions were lead by Hugonin one which lead to Coffin Bay where an Indigenous man who was spearing fish was shot and killed despite the expedition knowing he had nothing to do with the raids. The expeditions were seen as a great failure and the men were appointed to stay in town as guards rather than try to battle the Indigenous army an unfamiliar environment.

Ultimately the Indigenous resistance was broken by disease and famine, and by 1844 Eyre Peninsula was well in the control of the Europeans (Pope 1989:93–97; Foster and Nettelbeck 2012). However, although the Indigenous population was devastated across the Eyre Peninsula, especially around the Port Lincoln area, conflict continued with the frontier pastoralists pushing further north westerly through the peninsula (Casanova 1992:82). The period of conflict between the Indigenous population of the Eyre Peninsula and the colonists occurred during the frontier expansion of the pastoral industry across the Eyre Peninsula. Its effects on the pastoral industry, an industry still negotiating boundaries and land usage however, continued to influence the operating of runs and pastoral facilities, as evidenced in Grguric's (2007,

2008) research into colonial frontier architecture.

Grguric's archaeological investigation of structures that form part of an outstation named “Central Outstation” near Sheringa, is close to the northern extent of Price Maurice’s legendary west coast run. The site was leased in 1856 during the early expansionist period of Maurice’s activity in Eyre Peninsula. The only structure remaining on the site is a ‘Men’s Hut’ which is believed to have been built close to the start of the lease in 1856, though no documentary evidence was found to validate this assumed construction date. Research focused on this structure accesses a local myth that the structure has inbuilt defensive features designed to aid fortification against Indigenous raids, as do similar inbuilt fortification claims for several other frontier structures around South Australia.

Typically, Australian frontier structures had very similar design features to their European counterparts, showing linear cell plans with windows and doors on the front wall and a total absence of windows and doors on the rear wall of the building. The European rear wall is typically oriented facing the south so as to front the prevailing northerly winds, a pattern common in the Australian counterparts, facing the direction of the local prevailing winds (Grguric 2008:69). Differing in design from other colonial frontier structures however, the rear wall of the alleged defensive structures assessed show ‘tiny windows’ along the rear wall. These ‘tiny windows’ are about 20 centimetres wide in the case of the central outstation site on the Eyre

Peninsula. Interpreting these in favour of the myth, arguing they are likely a defensive feature designed to allow the pastoralists to fortify the building and provide a range of visibility for rifles, Grguric makes the case that based on Price Maurice's past experiences with attacks and the violent local history of the area a defensive structure makes sense. He also argues that this fortified wall was facing sheep yards as these were the likely targets for raids (Grguric 2007:170).

This historical research is particularly relevant to interpretations of the Mount Dutton Bay site, as it is located nearby, the buildings on site were commissioned and owned by the same owner, Price Maurice and have similar features.The possible counter point noted in Grguric's argument, again applicable to the Mount Dutton Bay site, is the dates of the buildings are quite late in the history of Indigenous conflict in the area, which was drawing to a close due to the devastation to the Nauo Nations population by that time. However, resistance was still occurring during this time and, an attitude of fear may have lasted much longer than the events that originally invoked it (Grguric 2007:169), prompting Maurice to stick with established models.

3.4 Conclusions

This review of historical sources shows that Mount Dutton Bay, as part of the Coffin Bay Area in general, has a complex history built from varied resource exploitation industries, both maritime and terrestrial and associated colonial era trials, solutions and frontier complications. The bay itself was a centre of maritime activity focused around oysters, fishing and later guano industries, as well as transport and trade connecting the region with the rest of the colony. The pastoral frontier faced a number forces and pressures influencing the foundation of the borders of the early runs which became the framework of roads and facilities in the region. As much as capitalising on the resources available in the area, the pastoralists capitalised on the lease system and later land survey for purchase. Added to this is Grguric's research demonstrating a valid archaeological interpretation of structural design and site layout being influenced by the animosity between the colonists and the Indigenous people of the Eyre Peninsula, providing an excellent example of the complexity of the region and the many influences on the settlement, behaviours of the colonists.

Mount Dutton Bay then, can be seen as a point of connection between the region's maritime and terrestrial industry which was not just a shipping point connecting the area with the far away outside but also the resources and industry of the bay itself and its islands. Such a connecting hub clearly created a local culture, whose mixture of diverse characters created social activities such as woolshed dances, and cottage tea shops, clustered at the

bridging coastal position of the Mount Dutton Bay jetty. The following chapter explains the methodology designed to interpret this complex, multi-layered site with a view to understanding the entire site, rather than restricting research to individual aspects of it.

CHAPTER 4: Methodology

4.0 Introduction

Where chapter 2 reviewed previous literature to determine the gap in spatial archaeological interpretation of Mount Dutton Bay as a maritime coastal landscape, chapter 3 discovered the complex historical cultural character of this site that has resulted from colonial resource exploitation and colonisation processes. Building on this foundation, chapter 4 now describes the methods this research employs to both the physical surveys of the Mount Dutton Bay area, and to researches of archival data sources, including the interpretation and visualisation of data. Each data collection style generates information about the site following different methods which together make up the data for the interpretation of this multi-vocal site. The methods employed for this research include pedestrian surface surveys, total station survey, photogrammetric site recordings, aerial landscape photography and photogrammetric modelling.

4.1 Historical Archival Data

Archival research was conducted at the South Australian state archives with the aim to find information on the early spatial landscape of Mount Dutton Bay and surrounding region. Any maps uncovered were scanned and georeferenced using the georeferencing toolbar in ArcMap. Georeferencing in ArcMap was achieved by placing marker points on the scanned image and placing a corresponding marker at the same location on satellite imagery with a spatial reference. Basemap imagery freely available through ArcMap software was used to reference the scanned images. Visual inspection of the maps were also made in their unreferenced form. Figure 4.1 shows some markers placed during the georeferencing process.

Figure 4.1: ArcMap Georeferencing toolbar used to place green markers on archival map and red markers on corresponding locations on georeferenced satellite image

4.2 Study Areas and Site Access

Figure 4.2: Site Extent and Areas Accessed During Field Work

Field surveys were limited by access and only conducted on publicly accessible areas and the property on which the woolshed is situated with permission of the current owner. A neighbouring property was part of the original woolshed complex and was the location of the original homestead which has since been demolished (Coxhill et al. 2006). No permission to access this property was obtained for this research so it was not included in the survey area. Figure 4.2 shows the areas accessed and highlights un-accessed areas surrounding the woolshed complex.

4.3 Surveys

Surveys were conducted to assess archaeological materials present within the study area in selected terrestrial and underwater areas as well as to record heritage features, site extent, terrain and topographical relief. These surveys were undertaken between January 31st and February 11th 2016 as part of a field school conducted by Flinders University Archaeology Department.

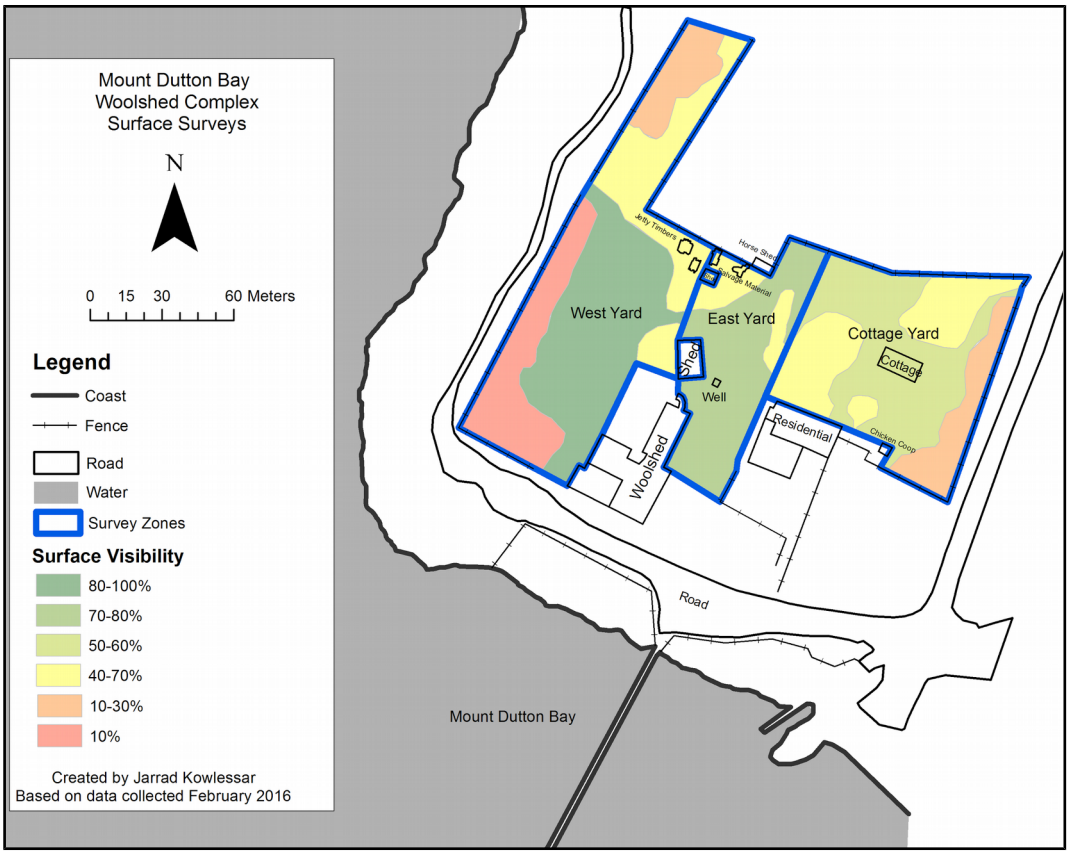

Figure 4.3: Mount Dutton Bay woolshed complex surface survey areas and ground visibility

Pedestrian surveys were conducted on three distinct terrestrial zones within

the study area: the woolshed complex, eastern and western foreshores and the small island directly visible from the end of the jetty. Pedestrian surveys are a reliable method for locating cultural material by having a surveyor walk along a set path and actively search for cultural materials in a small area to their left and right (Burke and Smith 2004:65). Pedestrian surveys were selected due to the clear visibility of surface situated cultural material which may offer further understanding of human behaviour at the site. These surveys were conducted with the aim of recording any visible cultural materials and gaining an understanding of site extent specifically with association to the central woolshed complex. Handheld GPS units were used to record any cultural material present, photographic recording was undertaken for each artefact recorded. Individual artefacts were recorded unless clearly associated with a localised scatter which was then recorded collectively as an individual record. During recording no discrete categories for artefacts were selected and all information was recorded descriptively for each individual artefact or scatter. Categories were later chosen to standardise the data based on the materials observed. Each zone surveyed required individual survey sampling due to ground cover and spatial extent of the zone.

4.3.1 Woolshed Complex Outside Yards

The yards surrounding the woolshed and cottage displayed a large number of visible cultural materials on the surface including ceramic, glass and metal

fragments. Systematic surface surveys were conducted to identify all surface material on the areas immediately adjacent to the woolshed and cottage. The small area of these yards allowed for complete survey coverage of the outside yards which were surveyed to the nearest fence lines. Survey personnel were spaced at 5 metre intervals each person observing 2.5 metres to either side as they walked short transects with clearly marked endpoints. The woolshed yard areas were separated into three sections: the east and west yards of the areas surrounding the woolshed, and the yard surrounding the cottage.

Ground visibility in the east yard was mostly good with 70-80% of the surface visible. Ground cover in the east yard was mostly sparse grass patches, exposed earth and some lightly gravelled pathways. The east yard survey area covers 3609.39 square metres. Figure 4.3 shows the perimeter of the east yard survey and the ground visibility within the survey area. Ground visibility in the west yard was excellent. The majority of the yard was cleared open ground with 80-100% visibility. The north west area of the yard had some grasses and a more limited visibility of 40-60% and the west edge of the yard was overgrown with less than 10% visibility. The west yard survey area covers 9010 square metres. Figure 4.3 shows the perimeter of the west yard survey and the ground visibility within the survey area. The ground around the cottage yard was mostly open with some patches of vegetation and grasses. The ground offered 50-60% surface visibility for most areas with some scarce patches of dense vegetation offering no visibility. The cottage

yard survey area covers 6526.65 square meters. Figure 4.3 shows the perimeter of the cottage yard survey and the ground visibility within the survey area.

In total the woolshed surface surveys covered an area of 19146.04 square metres. Table 4.1 shows the ground visibility in total area as a percentage of the total survey area.

Table 4.1: Ground Surface Visibility During Woolshed Complex Surface Surveys

Surface Visibility	Area (sq m)	Percentage of total Survey
< 10%	1983.72	10%
10-30%	2033.39	11%
40-60%	4161.08	22%
40-70%	893.19	5%
50-60%	3298.99	17%
70-80%	2944.65	15%
80-100%	3875.14	20%

4.3.2 Shoreline Surveys

A number of cultural materials were visible along the foreshore and beaches of the northern edge of the bay on which the woolshed complex is situated. Surveys were conducted to record the artefacts and to gain an understanding of the extent of their distribution. Shore line surveys were walked in pairs of

two spaced 10 metres apart. Visible artefacts were photographed and their position recorded with a handheld GPS unit. The beach areas offered exceptional visibility and surveys were performed at low tide offering the most exposed land to survey. Some of the foreshore areas had thick vegetation and only offered 20-30% visibility.

4.3.3 Island Surveys

Historical research revealed that the small island near the woolshed may have been used to access guano which was sold on the jetty (Casanova 1992:43). Pedestrian surveys were undertaken on the small island to determine if any cultural material is present thereupon. The island exhibited two vegetation patterns which each offered different access to surveyors; flattened grasses covered in guano deposits from bird population and thick inaccessible shrubs. The total area of the island was measured from aerial photography and found to be 8394 square metres in area. The area accessed during the survey was 4159 square metres which covered 49.5% of the total area of the island. The areas accessed offered poor surface visibility of less than 10% of the surface visible beneath the flattened dry grass. Surveyors walked in pairs spaced five metres apart and surveyed 100% of the accessible area. The areas surveyed are shown in figure 4.4.

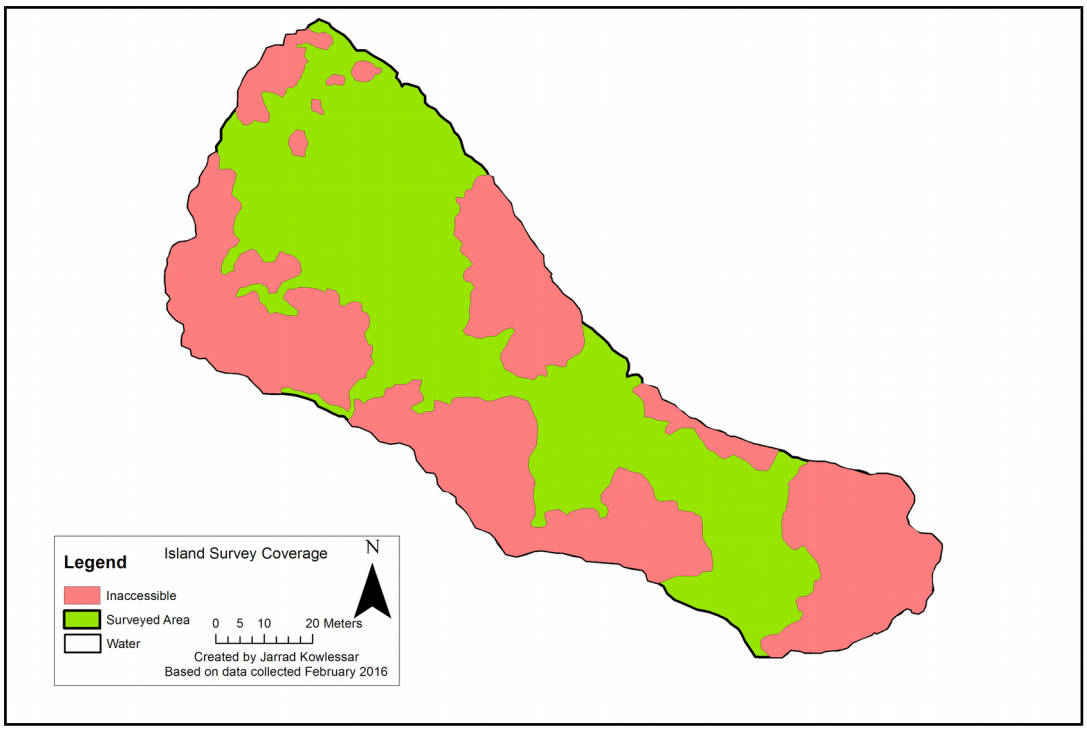

Figure 4.4: Ground Surface Visibility During Woolshed Complex Surface Surveys

4.4 Site Recording

The layout of the woolshed complex was recorded to capture the spatial arrangement of material culture and topographical surface for the site. Three methods were used to record these spatial features of the site: total station survey, terrestrial photogrammetry, and aerial photogrammetry.

4.4.1 Total Station Survey

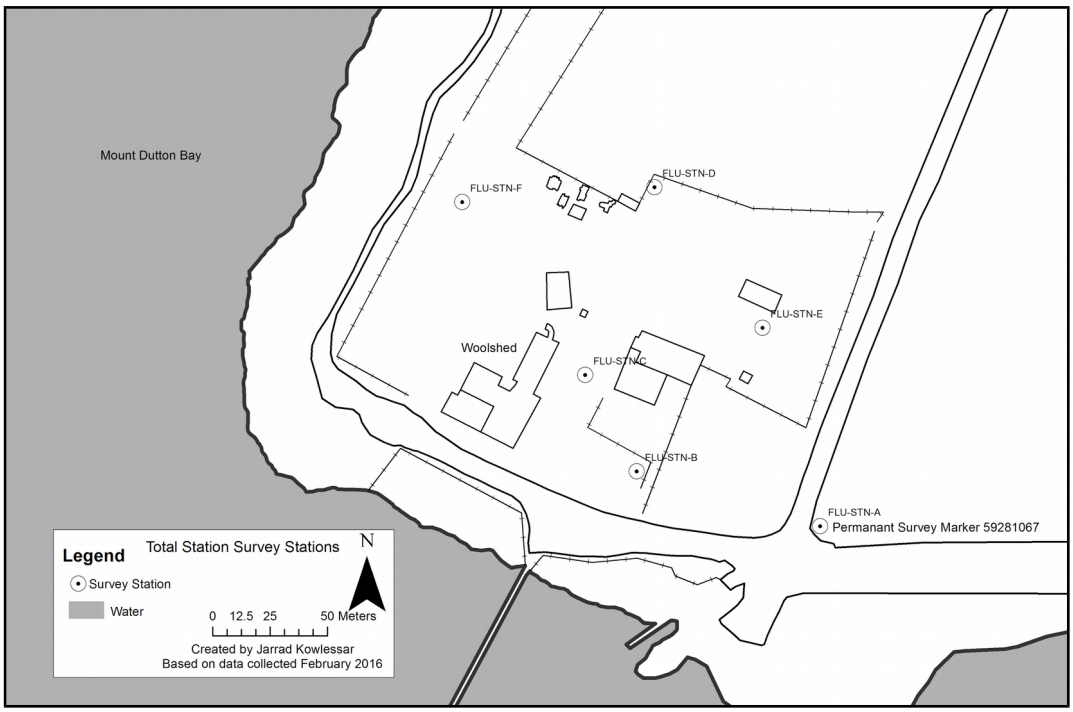

Figure 4.5: Total Station Survey Station Points

The total station survey was conducted to measure points around the base of the buildings, surface features such as fence lines, roads and walkways as

well as surface elevation. The purpose of this data is to record the spatial layout of the site as well as to provide tie points for data integration and for georeferencing photogrammetric models. The total station used the nearby permanent survey marker 59281067 as a central control point for the survey. Survey marker 5281067 is recorded to have a class D vertical position which allows a maximum vertical error of 50 millimetres to its purported vertical elevation. The horizontal location of this control point is recorded as being a class Z position which was derived from digitised imagery (Inter-governmental Committee on surveying and mapping 2007). The recorded position for the permanent survey marker was deemed to be too inaccurate for use and a hand held GPS unit was used to record the position of the marker. The survey conducted an open traverse establishing six stations around the woolshed complex from which to operate the theodolite.

Each station had a back sight to one or more established stations with the first station situated on permanent survey marker 59281067. The station locations were selected to provide complete coverage of the woolshed complex making sure that good visibility of each feature and the terrain was achieved. Figure 4.5 shows the location of the survey stations and the permanent survey marker. Red survey markers were placed on select building corners and edges which were surveyed specifically with a building code. These markers were placed so as to be visible in both terrestrial and aerial based photos to be used as georeferencing points for the photogrammetric models.

4.4.2 Photogrammetry

Photogrammetry is a survey method that uses multiple digital photographic images of a subject, taken from multiple angles with overlapping coverage to generate an accurate three-dimensional model of that subject (De Reu et al. 2013; McCarthy and Benjamin 2014). Photogrammetry was selected for many of the site features as it is a detailed survey method that records the spatial extent of the features in an accurate and comparable way to traditional two dimensional recordings (De Reu et al. 2013; McCarthy and Benjamin 2014). This recording allowed individual site features to be recorded in the detail required to capture useful multi-vocal archaeological information. With site features which have many important details such as the spatial layout and style of the structure as well as the makers marks on the bricks and erosion patterns visible, photogrammetry allowed the capture of all this visual and spatial data in one unified methodology. The visual data of the photographs showing colour and contrast is linked to the geometric information provided by the model produced as well as that models spatial location. This allows intrinsically integrated interpretation of these separate components. The choice to use a method that strengthens data integration was made to allow holistic interpretation of a larger landscape with individual site features viewed in their place within this connected system and to minimise an interpretive disconnect between data and reality (Bourdier et al 2015; Frischer and Dakouri-Hild 2008; Hermon 2008; McCarthy and Benjamin 2014).

The structures present on the landscape were individually recorded for photogrammetric modelling. These structures are woolshed, well, cottage, and jetty. The terrain itself was also recorded for photogrammetric modelling using aerial photography. The photography was taken with a Nikon D300 SLR camera, using a wide angle lens with focal lengths between 18mm and 55mm. Photos were taken with at least 30% overlap of each adjacent image. Images were taken with a minimum aperture of F.17 to maximise the depth of field and exposure was controlled using ISO and shutter speed. Shutter speed was never less than 1/100 seconds so as to avoid any motion blur in the images. Exposure was kept even between images accounting for changes in lighting conditions from different angles of view.

For the buildings, the photos were taken from around five metres away from the structures at two heights, the first showing the ground through to the mid level of the building and the second showing the upper level of the building. These photos were taken incrementally rotating around the building until complete coverage was achieved at both heights. A third set of photos were taken from a greater distance of around 20 metres from the structure to capture the roof sections and to make sure there was complete coverage and each part of the building was recorded in three or more images. Additional images were taken to record the cottage veranda and the woolshed porch, which required more detailed photography due to the over hanging sections. The front wall of the cottage was also recorded in greater detail so as to capture finer details including some graffiti carved into the stone wall as well

as the seam of an adjoined structural section of the building and the front stairs leading to the porch. The well was recorded with twenty four images taken from close and medium distances to the well.

The Jetty was recorded in six separate sections so that the model could be processed piecewise and recombined. This approach was chosen based on preliminary results of a single data set processing which produced a poor representation of the jetty with distortion caused from image recognition confusing visibly homogenous sections. A trilateration survey was conducted to give marker points a spatial control network so that the six separate models could be accurately recombined based on these known locations. The marker points were recorded in the images using ‘coded targets’ produced by the Agisoft Photoscan software package (Agisoft 2013). These targets are each a uniquely coded image which were printed onto mylar paper and secured to fixed positions on the jetty. The Photoscan software package can automatically recognise individual coded targets based on their unique images. This allowed the known points from the trilateration survey of the jetty to be recognised by the photoscan software.

The terrain and landscape around the woolshed complex was recorded using aerial photography. This photography was captured using a DJI Phantom remotely piloted radio controlled aircraft (drone). The DJI Phantom Vision 2+ drone has a mounted 12 megapixel camera on a gimbal which works to keep the camera facing 90 degrees to the ground regardless of the orientation of

the drone.

The small unnamed island near the end of the jetty was also recorded with aerial photography using the DJI phantom drone. These images were captured at midday.

4.5 Data Processing

The images captured for photogrammetry were processed using Agisoft photoscan software package to produce three dimensional models of the data. The Photoscan software divides model generation into four phases: photo alignment, generating a dense point cloud, building a mesh and texturing the mesh.

The photo alignment phase takes a set of photos and estimates camera locations from within the images. The Photoscan software is able to automate this process however this alignment can be guided by placing markers on common points on the images. For each model markers were placed on points which were clear and easy to identify in the different images for each data set. Markers were also placed on visible red survey markers so as to provide integration of the total station data for model georeferencing. Marker placement for the Jetty sections was automated by the Photoscan software based on the Photoscan coded targets placed during the data collection step. The alignment process produces a sparse point cloud showing an estimated location of points which make up the model and also shows the estimated location and viewing angle of the camera for each image and the number of images aligned out of the total dataset. The sparse point cloud and estimated camera locations were assessed for accuracy before model processing proceeded. Figure 4.6 shows the sparse cloud representing the cottage. Where necessary, additional markers were placed to guide camera alignment. In some cases markers were placed based on

specific gaps in the alignment. After the cameras are aligned with markers placed with geographic coordinates the ‘optimise cameras’ process was employed. This process uses the known coordinates of the marker positions to make corrections to the image alignments.

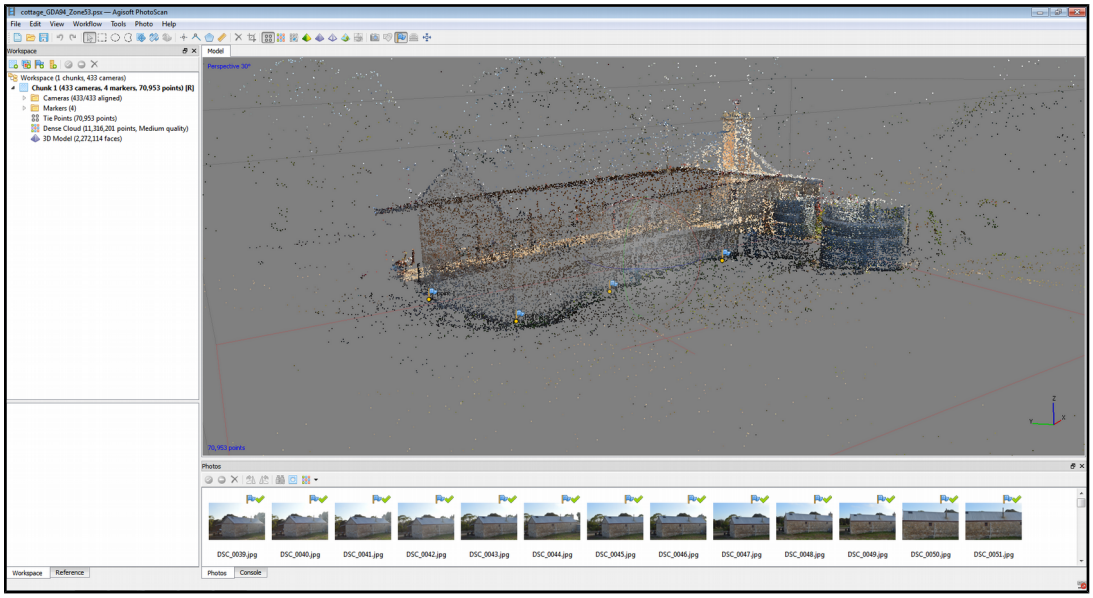

Figure 4.6: Agisoft Photoscan sparse point cloud of the cottage viewed from the south with markers placed on survey points

The second phase is the processing of a dense point cloud. This step derives a depth map for each photo and places points at the depth of the features identified therein. This process can be affected by noise, grain and blur in the images and therefore a depth filtering process is integrated in this step which removes points judged to be separate for the overall geometry of the feature being recorded. Depth filtering can range from mild to aggressive or be deactivated all together. Where the models have small intricate details that may be misunderstood as noise mild depth filtering was used so as to minimise the accidental removal of relevant details (Agisoft 2013). Mild depth

filtering was selected for the all the models produced except the landscape. Aggressive depth filtering was selected for the landscape as the aim was the model the terrain and not distinct detailed or complex features thereupon. The quality of the point cloud developed can also be selected from low, medium, high and ultra high. Each setting increases the density of the points placed in the cloud. High was selected for all the models as this was judged to produce a point cloud dense enough to capture the details in a visually clear and spatially accurate way. Figure 4.7 shows the dense cloud representing the cottage.

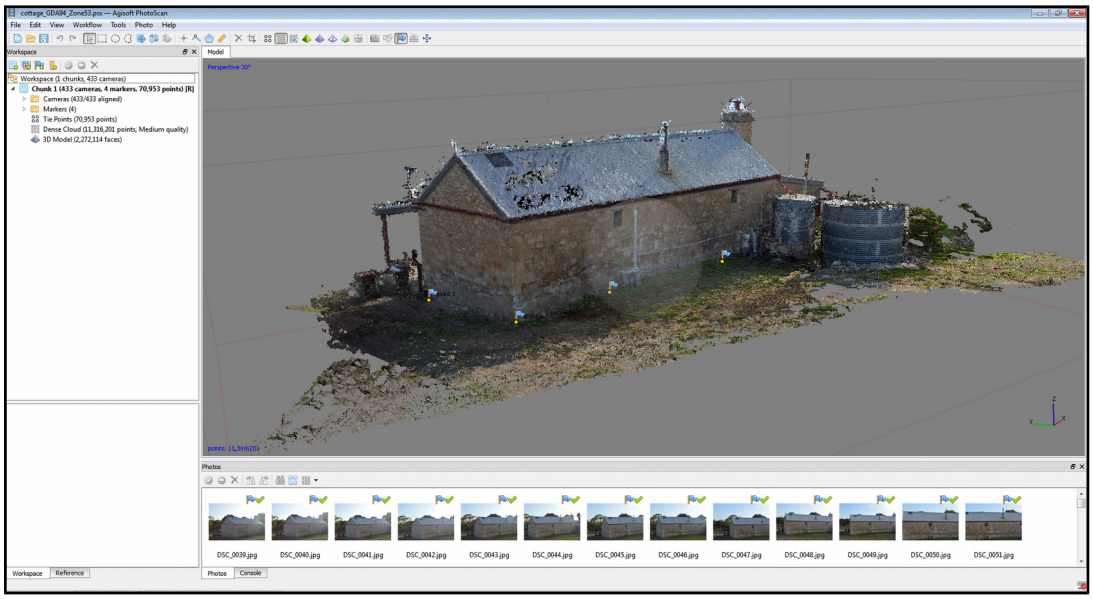

Figure 4.7: Agisoft Photoscan dense point cloud of the cottage viewed from the south with markers placed on survey points

A mesh is a solid shell that represents the geometry of a subject. Unlike a point cloud which is made up of many disconnected points in space a mesh is made up of flat faces all connected to create the shell of the object. The mesh generation phases has two surface types available: arbitrary and

height field. Arbitrary bases the mesh on the dense point cloud as close a possible making no assumptions about the underlying shape of the geometry that will be produced (Agisoft 2013). Height field is optimised for flat planar surfaces. Height field was selected for the generation of the landscape model whilst arbitrary was selected for the other models. The mesh can be generated with a different face count, where more faces will produce more complex and detailed geometry and less faces will simplify the fit to the dense point cloud. Medium settings were selected to retain a good representation of underlying geometry yet keep the models file size smaller to aid with further data integration. Finally interpolation was selected which allows the automatic detection of holes and gaps in the point cloud which are misrepresentations of the true geometry and fills these gaps in the mesh generation step. Figure 4.8 shows the mesh representing the cottage.

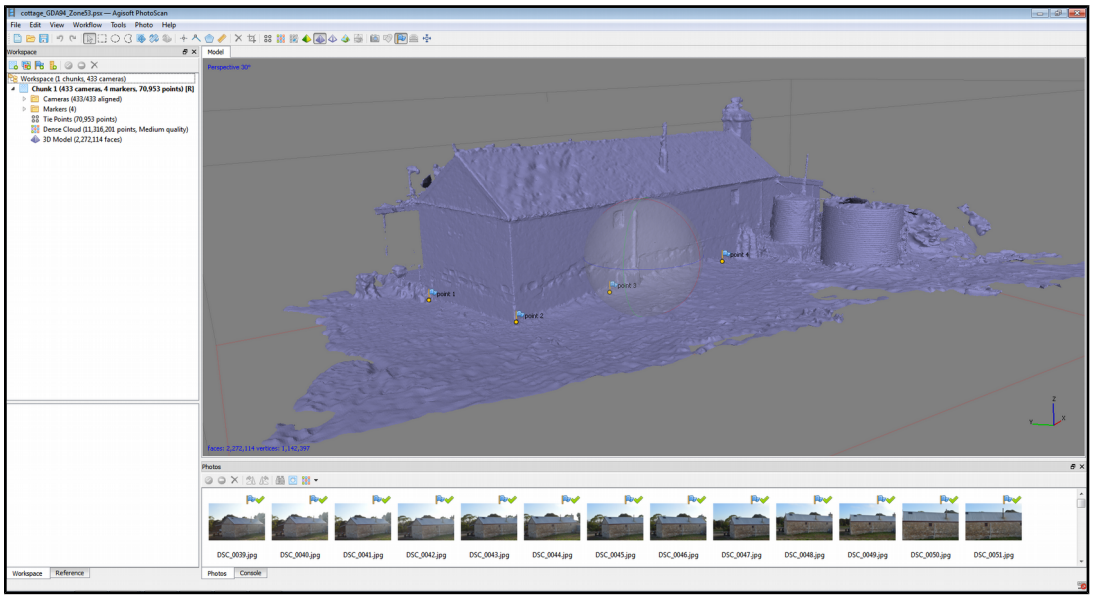

Figure 4.8: Agisoft Photoscan untextured mesh model of the cottage viewed from the south with markers placed on survey points

For texture generation generic mapping mode was selected for the buildings this mapping mode is the most adaptive to complex geometry with many

outward facing edges. For the landscape models, orthophoto mapping mode was selected and the mesh textured from the top down perspective, so as to retain the detail of the aerial photography was taken at a fairly constant top down angle of view. Figure 4.9 shows the textured mesh representing the cottage.

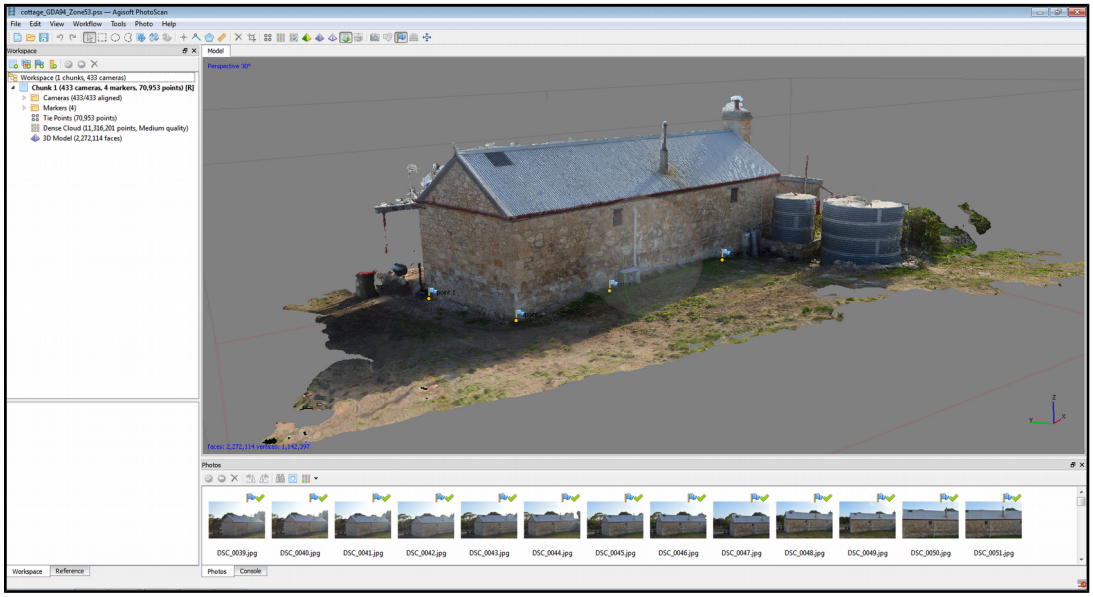

Figure 4.9: Agisoft Photoscan textured mesh model of the cottage viewed from the south with markers placed on survey points

The completed models were exported as 3D models in the COLLADA file type for further GIS integration. Models were exported with local coordinate systems as well as exported in a GDA 94 projected coordinate system.

Orthophotos were also generated from different orthographic perspectives. Orthophotos are two dimensional images that represent the features of the geometry as viewed from one fixed orthographic perspective (projection). All orthophotos were exported with georeferenced data for further data

integration. Orthophotos are produced as a function of Agisoft Photoscan.

4.6 Data Integration and Visualisation

All the data gathered was integrated into a central GIS for combined management and analysis. ArcGIS Pro software was selected for use to integrate the data as it allowed the integration of both two dimensional and three dimensional data sets as well as allowing detailed visualisation of the landscape.

3D model integration was achieved using the Import 3D tool available in the ArcGIS Pro software. This tool takes a COLLADA file and converts it into a multipatch feature. The multipatch feature class is a 3d feature class developed by ESRI for representation of three dimensional data in a GIS which can represent 3d textured geometry within geographic space and retain links with associated attributes tables (Esri 2012). The Multipatch geometry type has been identified as useful to archaeological representation of three dimensional features as it allows databasing, spatial analysis and querying of archaeological data whist retaining a detailed visualisation of the data (Katsianis et al. 2007; Dell'Unto 2015; Landeschi et al. 2016). The separate datasets were imported into a three dimensional scene and viewed together in their correct geographic position.

A digital elevation model (DEM) was generated from the elevation data of each point of the total station survey using the kriging surface interpolation method. Kriging is an interpolation method that makes estimates of values for unknown areas based on a set of known points. Kriging was selected as it

has been found to be the most accurate interpolation method for elevation data (Arun 2013). The kriging tool was used in ARCmap software package, using the 3D Analyst toolbox. The default options were chosen for this tool as this makes use of 'ordinary kriging' which makes no assumptions of trends in the data and will produce an unbiased result (Oliver 1990).

The sampling of the total station survey was very extensive on the property however the site of the old homestead was inaccessible. This leaves a gap in the survey data for that area. The Kriging surface produced values for this area however those values will be less reliable than other area of the site. For this reason a second DEM was generated from the photogrammetric modeling of the aerial photography which had good coverage of this area. Photoscan software was used to export this DEM.

A comparative analysis was conducted to assess the accuracy of the DEM produced using photogrammetry based on the DEM produced from the total station survey data. The cell sizes of both raster (pixel/cell based) images were the same and the images were clipped so that they covered the same area. The raster calculator tool from the spatial analyst toolbox in ArcMap was used to subtract the photogrammetry surface from the total station surface cell by cell. The resulting surface shows values close to zero where the two DEMs are similar and then values that are greater or less than zero show disagreement between the models.

4.6.1 Visibility Analysis

To better understand the placement of the structures of the site, and the shearers quarters in particular, a 'visibility' analysis was conducted from the rear windows of the shearers quarters cottage building. A visibility analysis identifies those areas which are visible from a specific point or set of points. Visibility has been identified as a useful factor in understanding archaeological sites (Spencer 2007; Richards-Rissetto et al. 2012) and Grguric (2007; 2008) demonstrates the application of basic visibility analysis on interpreting the defensive application of windows on colonial frontier stations.

The visibility analysis tool in ArcGIS pro was used. The visibility tool takes point data representing observer locations and a DEM, then returns a raster images showing which areas of the DEM have a ground surface visible from the input observer points. Visible points are given a 1 and invisible points are given a 0. These raster visibility surfaces were generated using the DEM interpolated from the total station survey and points representing the cottage windows. A second product of the visibility analysis was produced which is an Above Ground Level (AGL) surface. An AGL surface shows the height that an invisible surface would have to be raised before it was visible from the input observer points. This was produced so as to understand the areas where features such as people could still be seen from the input observer points, in this case the shearers quarters windows, even though the exact surface of the ground was out of site. The AGL surface is a continuous surface showing

unique values for every cell of the surface. As this was conducted with the interest of understanding where humans would be visible from the shearers' quarters rear windows. This surface was classified into height categories which represent different height brackets. These brackets were 0 to 0.5 metres, 0.5 to 1 metre, 1 metre to 1.5 metres, 1.5 metres to 2 metres, and all areas greater than 2 metres. This means that a 1.75 metres tall a human standing in the areas classed in the 1 to 1.5 metre category area will be visible from a height of 1 to 1.5 metres upwards which is likely to be about waist height and up, occluding legs and feet. So as to compare the visibility of this cottage structure to the similar Men's Hut structure recorded by Grguric's (2007; 2008), the height above ground visibility was calculated a second time from the location of the shearers quarters but with the windows lowered to the height recorded on the Men's Hut at Central outstation to uncover an explanation of the differences in these structures designs.

4.7 Conclusion

The multiple data collection methods employed by this study offer a comprehensive means to access all manner of relevant site data necessary to understand a complex site such as Mount Dutton Bay. This inclusive methodology also provides the means to test the strengths and weaknesses for each survey type regarding the broad questions archaeology may ask of multi-vocal coastal sites. From the pedestrian surface survey to the advanced technology of photogrammetric 3D modelling, each method brings additional information for understanding the full extent of the site. The following, chapter 5, presents the research results, leading to the interpretive discussion in chapter 6.

CHAPTER 5: Results

5.0 Introduction

The following data comprises all the of the measurements and recordings made on the site. The recorded materials are a comprehensive list of surface artefacts in the study area. However, previous and present owners have removed selected artefacts from the areas around the woolshed and cottage. The removed materials were predominantly industrial material gathered for a private collection. This collection is held on the site and is on display to the public. The collection has not been included in this thesis data as the materials are out of context and biased by unknown selection criteria.

The results have been organised into four thematic sections: pedestrian surveys, total station surveys, photogrammetry, and historical sources.

5.1 Historical/Archival Data

Figures 5.1 through 5.3 show the surveys that the original hundred map of Lake Wangary was based on. These surveys were drawn in 1871 and show notes taken by the survey office over the years that followed the survey. Notes show the location of the jetty construction and areas that were reserved by the marine board. Figure 5.4 shows the Mount Dutton Bay region of a hundred map of Lake Wangary dating 1892.

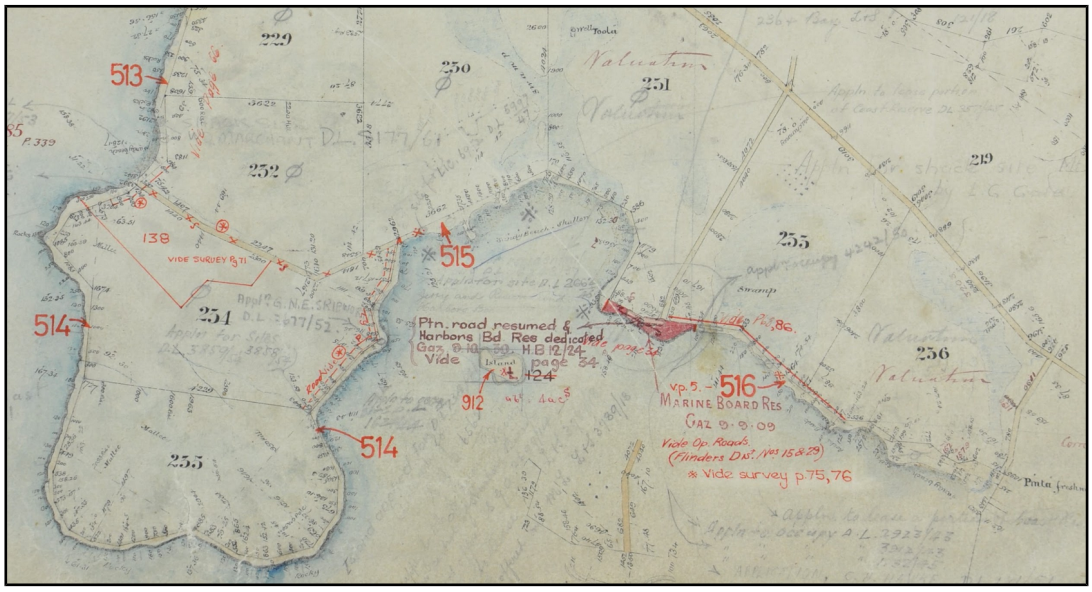

Figure 5.1: Survey Office Hundred survey 1871 (State Records of South Australia, Gepps Cross, Adelaide [SRSA] Hundred maps – Surveyor-General's Office [HM], GRG 35/586)

Figure 5.2: Survey Office map of north east edge of Mount Dutton Bay 1871 (SRSA GRG 35/586, HM)

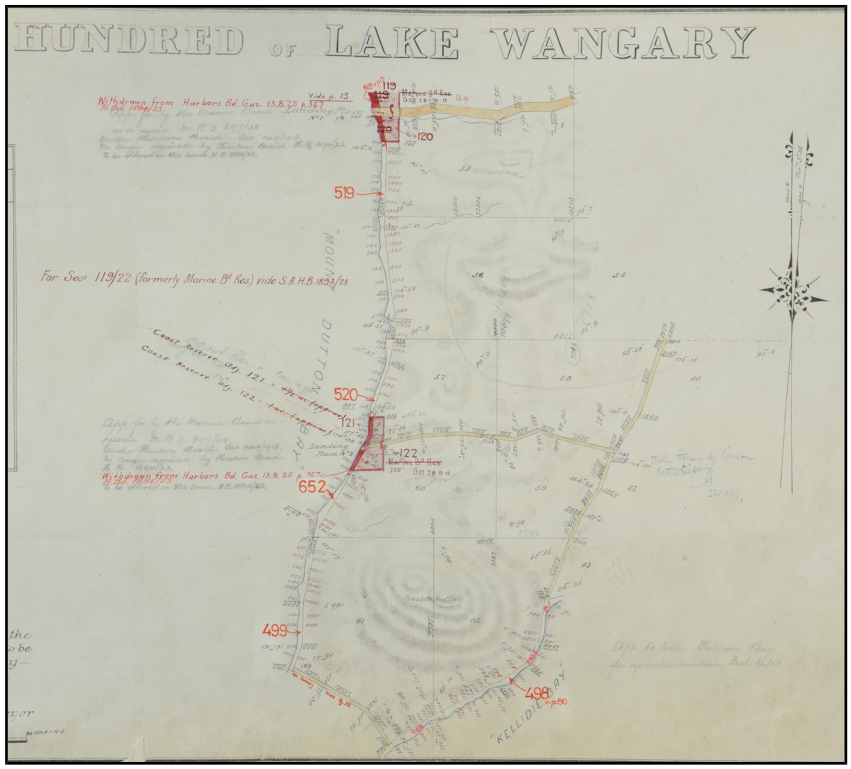

Figure 5.3: Survey Office map of east edge of Mount Dutton Bay (SRSA GRG 35/586, HM)

Figure 5.4: Hundred of Wangary 1892 (State Records of South Australia, Gepps Cross, Adelaide, Drawer system plans – Surveyor General's Office, GRS/6910/1)

5.2 Pedestrian Surface Surveys

A total of 225 artefacts were recorded during the pedestrian surface surveys. These were sorted into themes and material types. Figures 5.5 - 5.10 show the materials of each artefact recorded in the surveys for each area surveyed. Figure 5.11 shows the combined count of material types for all recorded artefacts. The material type of structures was not recorded been recorded so to distinguish them from loose artefacts recorded.

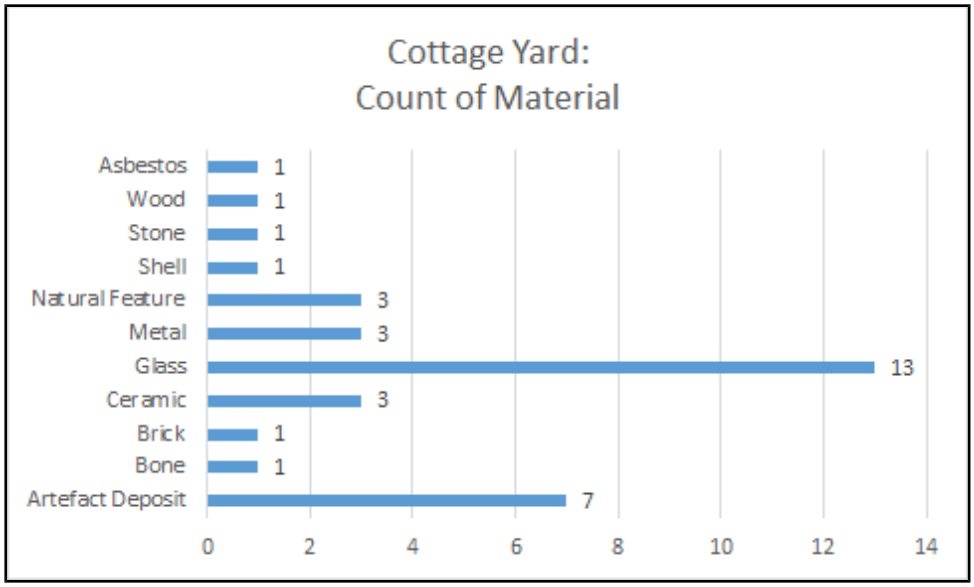

Figure 5.5: Count of artefact material types observed in the yard around the cottage

Within the yard around the cottage the most common type of artefact materials observed was individual glass shards. Artefact Deposits describe an area of associated glass and ceramic shards and this was the next most frequently observed feature in the area.

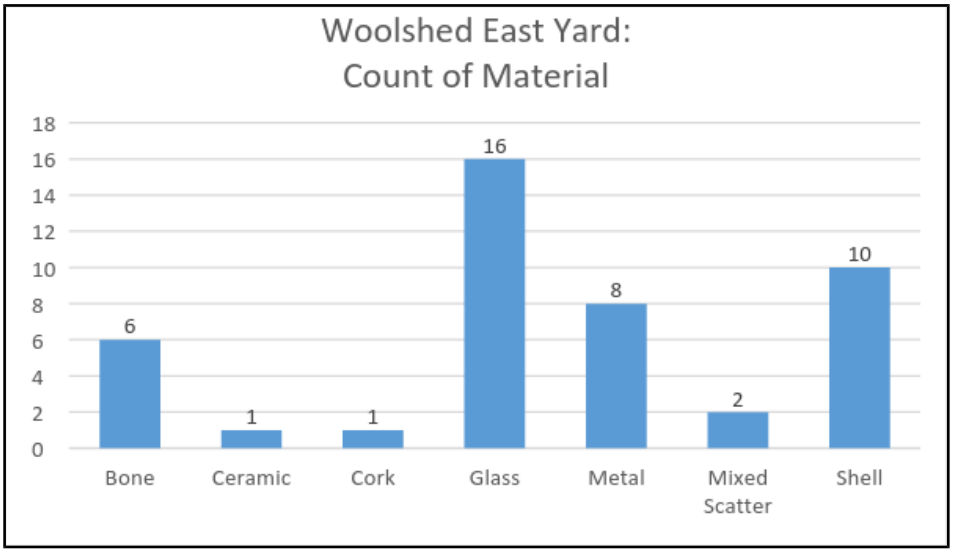

Figure 5.6: Count of artefact material types observed in the yard east of the woolshed

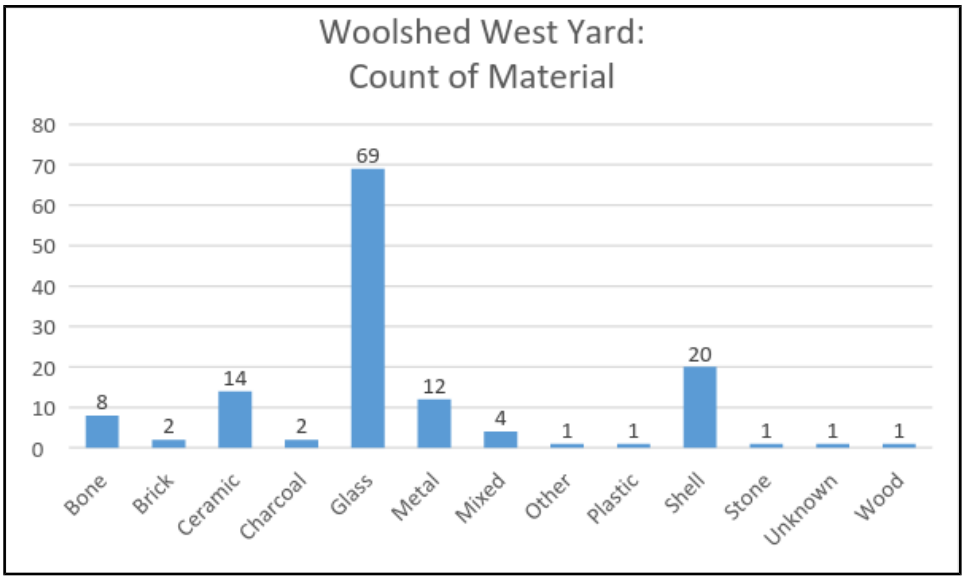

Figure 5.7: Count of artefact material types observed in the yard west of the woolshed

The materials observed in the areas around the woolshed were most frequently individual glass shards. The next most frequently observed material was shell followed by ceramic and metal respectively.

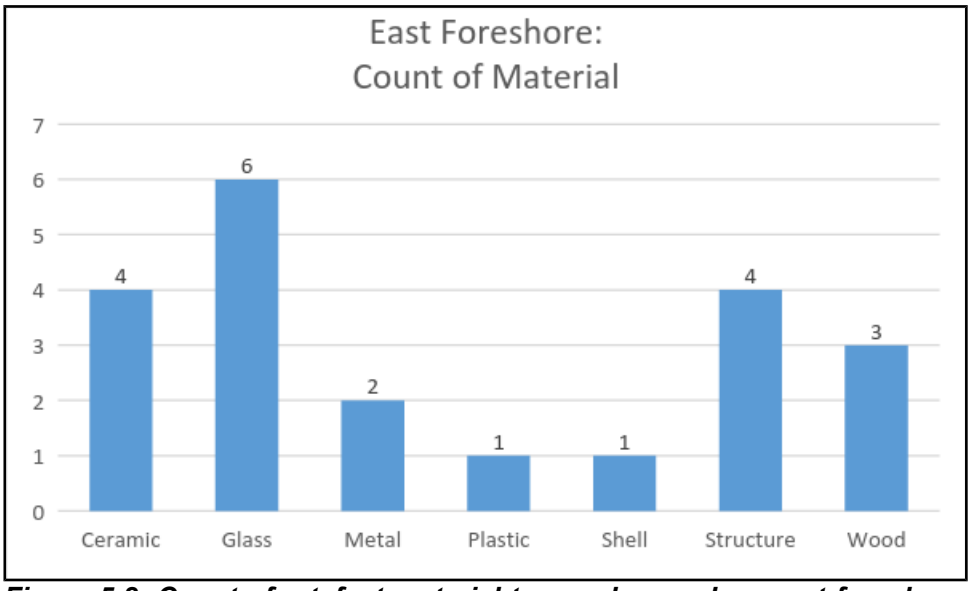

Figure 5.8: Count of artefact material types observed on east foreshore of Mount Dutton Bay

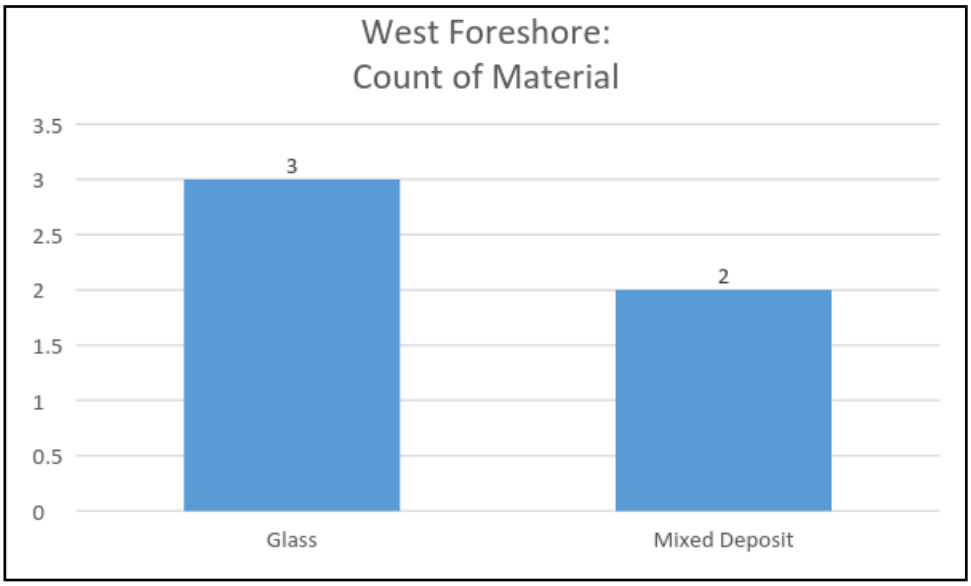

Figure 5.9: Count of artefact material types observed on the west foreshore of Mount Dutton Bay

The artefacts observed on the foreshores had a variety of materials. Far more material was observed on the East foreshore then the west and the

variety of materials was also greater on the east foreshore. In both directions glass was the most common material followed by ceramic which was often recorded in context with glass (recorded as mixed deposits).

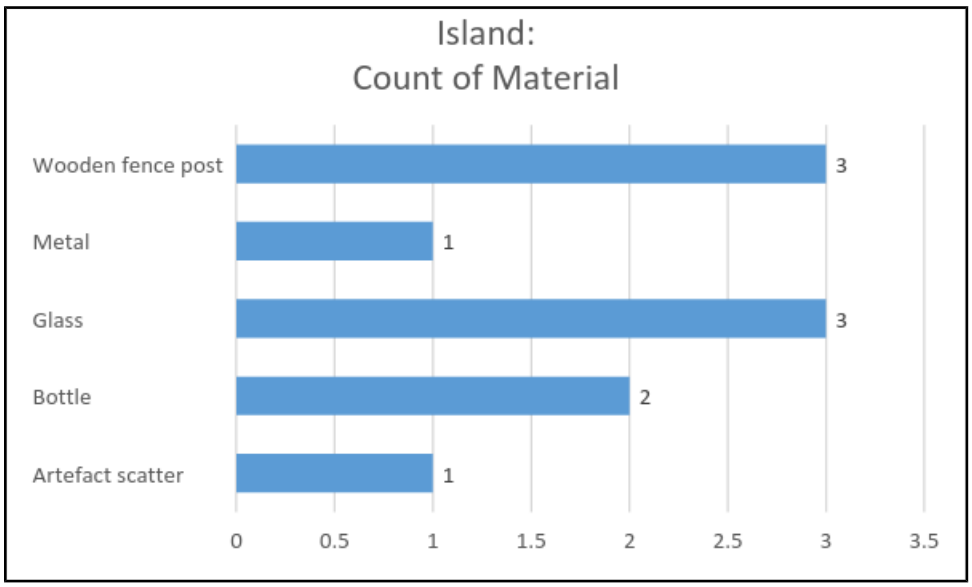

Figure 5.10: Count of artefact material types observed on the Island

A number of materials were observed on the small island near the Mount Dutton Bay jetty. The most common materials seen were wooden fence posts and glass. Glass was recorded separately to bottles to distinguish fully intact artefacts from shards.

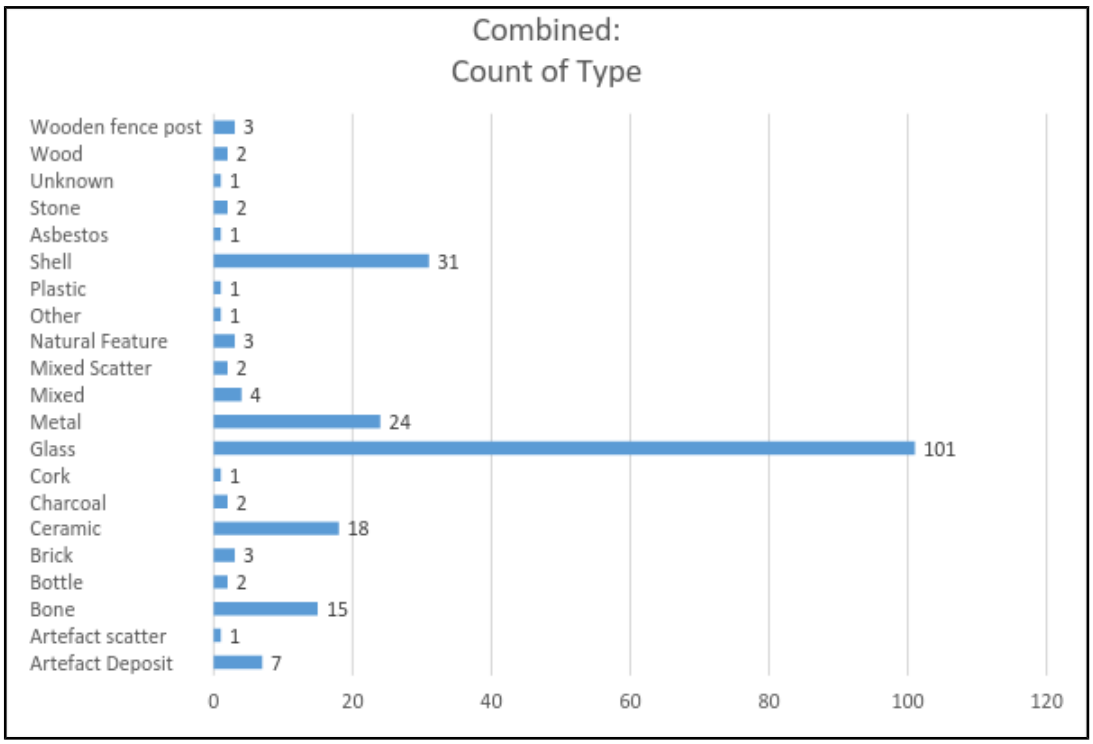

Figure 5.11: Count of all artefact material types observed in pedestrian surface surveys

21 different materials were identified among the artefacts recorded by the pedestrian surveys. Glass artefacts were the most common, however these artefacts were exclusively fragments and not complete objects. The only complete glass bottles recorded were found on the island. Following glass, the most frequent materials recorded were shell, metal, ceramic and bone respectively.

Figures 5.12 to 5.16 show a count of recorded artefacts from each survey area by the frequency of common theme. Table 5.17 shows the combined assemblage from all survey areas by frequency of theme.

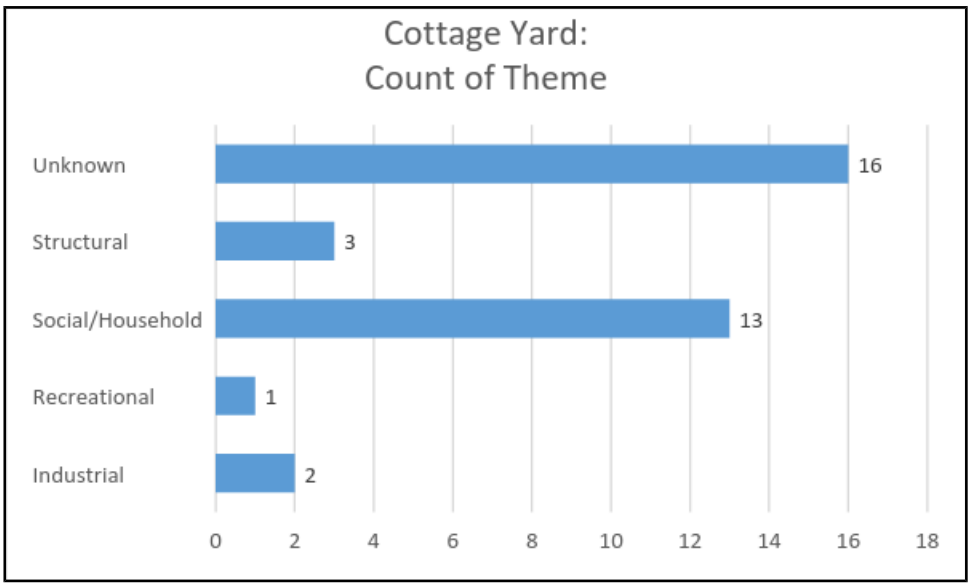

Figure 5.12: Count of artefact themes observed in the yard around the cottage

The most frequently observed materials around the cottage could not neatly fit any of the interpretational themes selected. The most common themes that was observed was 'social/household' followed by structural and industrial respectively.

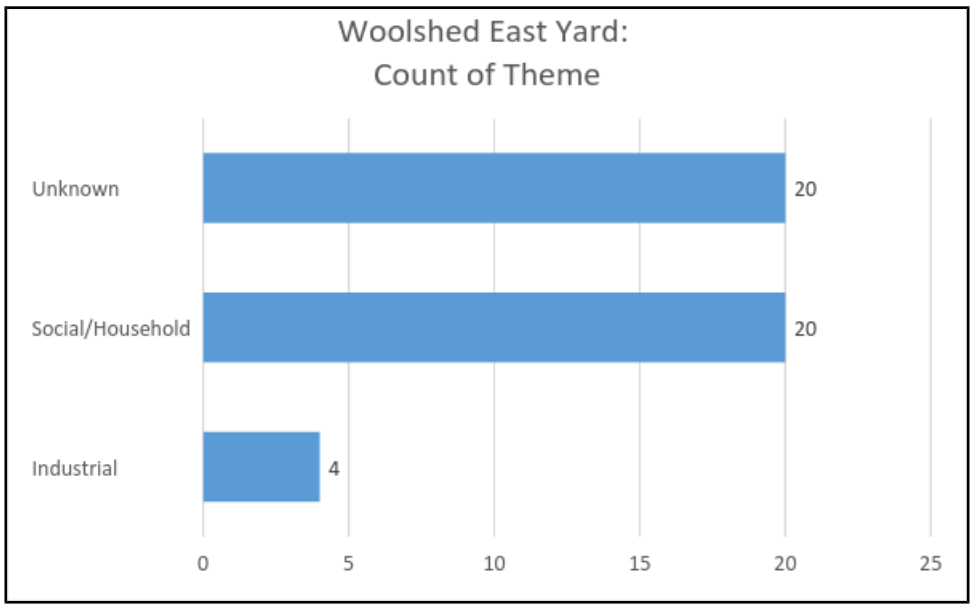

Figure 5.13: Count of artefact themes observed in the yard east of the woolshed

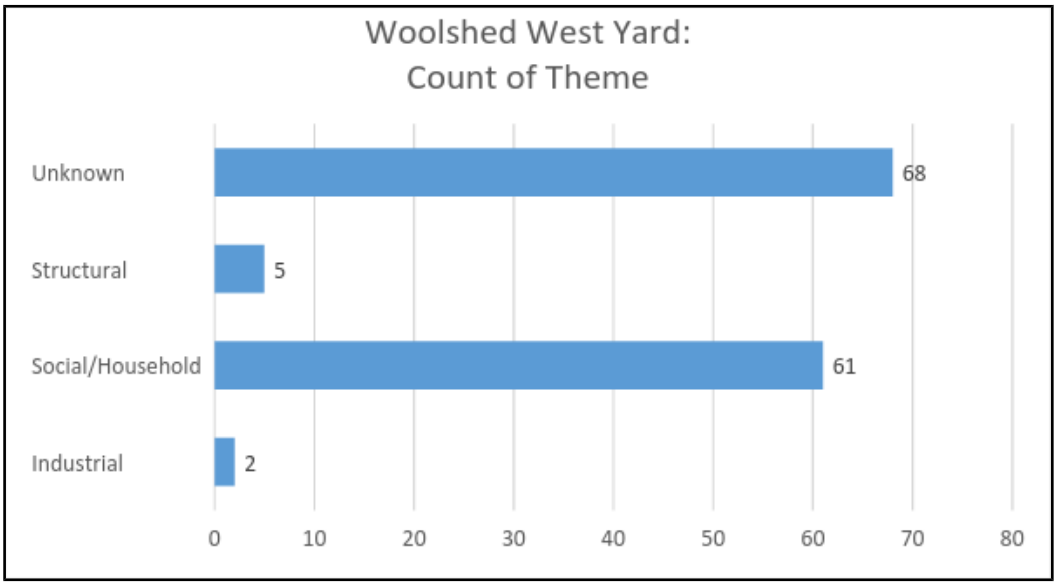

Figure 5.14: Count of artefact themes observed in the yard west of the woolshed

Many materials in the yards that surround the woolshed could not be appropriately categorized into one of the themes selected. Of those materials that could be categorised the most common theme was ‘social/household’. Despite the proximity to the woolshed the industrial theme was the least observed among those artifacts that clearly fit a thematic category.

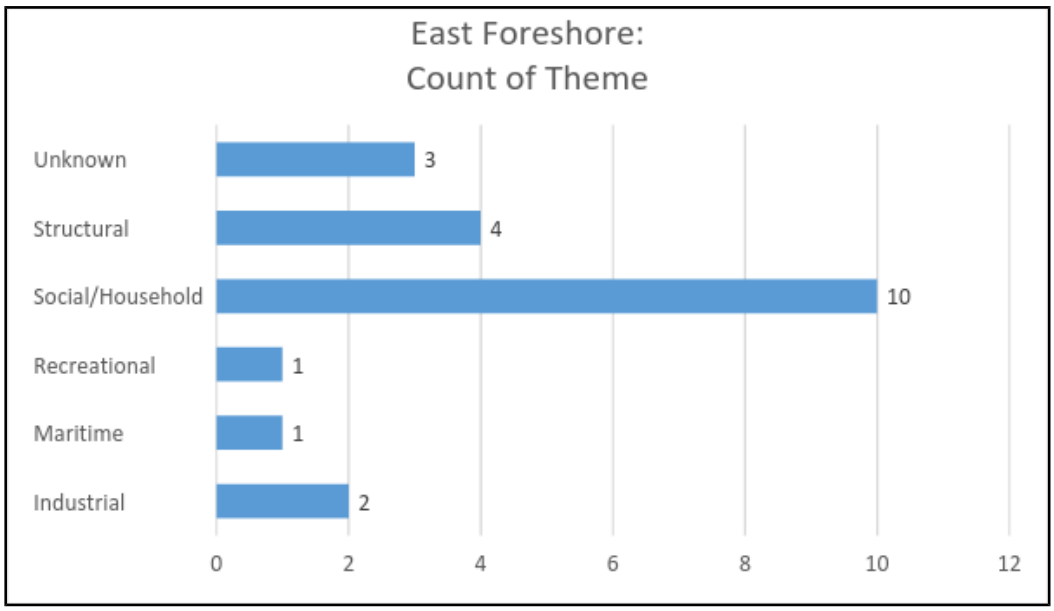

Figure 5.15: Count of artefact themes observed on the east foreshore of Mount Dutton Bay

On the west running foreshore only social/household materials were observed. Along the east running foreshore the most common thematic category observed was 'social/household' followed by structural. Industrial, recreational and maritime themes were also observed along with materials which did not fit any theme or the theme for which could not be identified.

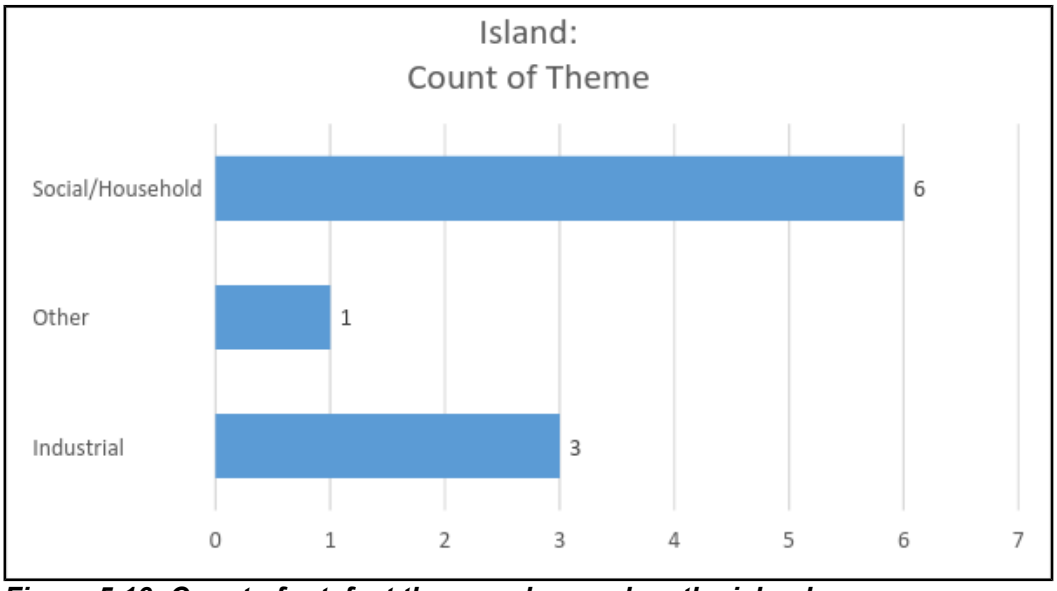

Figure 5.16: Count of artefact themes observed on the island

Three themes were observed on the island; ‘social/household’, ‘industrial’, and ‘other’. Other describes material that fit a different theme to those chosen for this project.

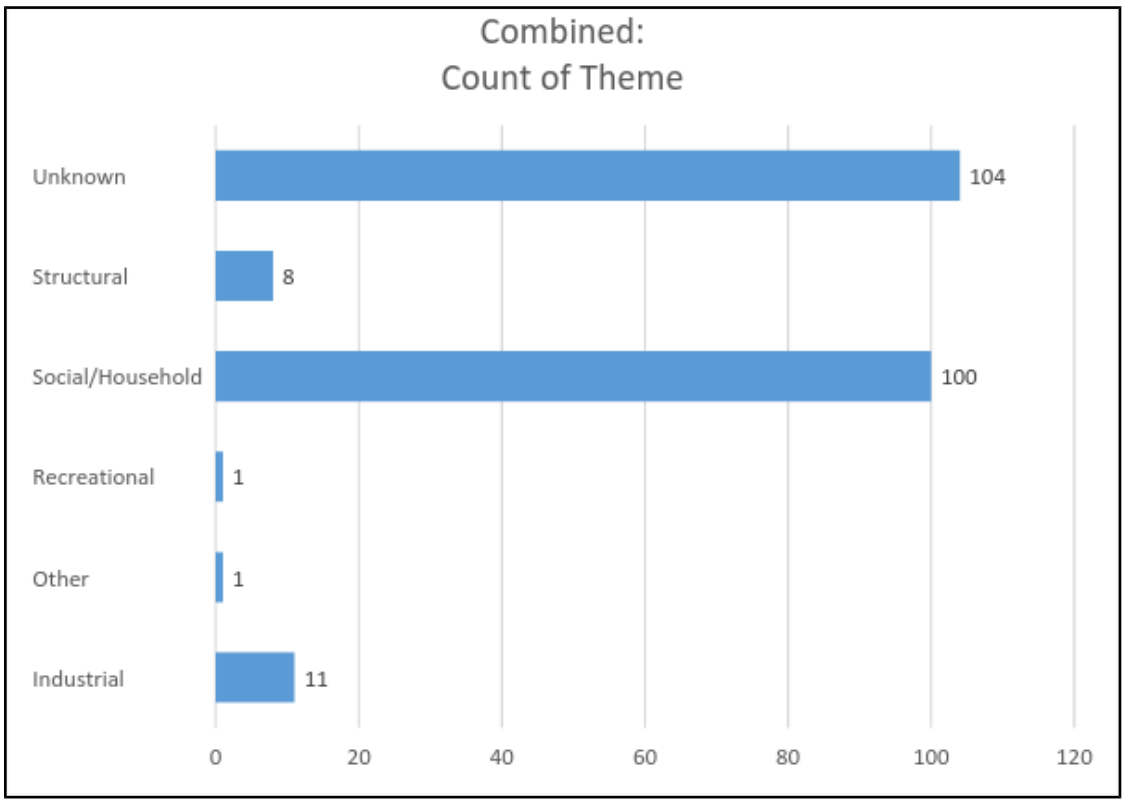

Figure 5.17: Count of all themes identified

Of the material that could be thematically categorized the most common was interpreted to be ‘social/household’ followed by industrial, structural recreational respectively.

5.3 Total Station Survey

Figure 5.18 shows all points recorded by the total station survey and the survey station points overlaid on aerial photomosaic of the site. The total station survey recorded 1480 points.

Figure 5.18: Total station survey of Mount Dutton Bay WoolShed Site

5.4 Photogrammetry

Figures 5.19 through 15.22 show renders of the textured 3D model of the cottage produced by the ground based multi-image photogrammetry. The Model clearly shows the building with details captured such as the makers marks on the bricks and graffiti on the walls of the cottage.

Figure 5.19: Photogrammetry model of the cottage viewed looking south west

Figure 5.20: Photogrammetry model of the front wall of the cottage

Figure 5.21: Photogrammetry model of the cottage steps

Figure 5.22: Photogrammetry model of the brick of the cottage stairs

Figure 5.23 shows a textured 3D model of the well located on the site. This model was created using multi image photogrammetry.

Figure 5.23: Photogrammetry model of the well

Figure 5.24 through 5.26 shows the textured models of the woolshed produced from multi-image photogrammetry. These models demonstrate the multiple perspectives in which the wool shed can be viewed.

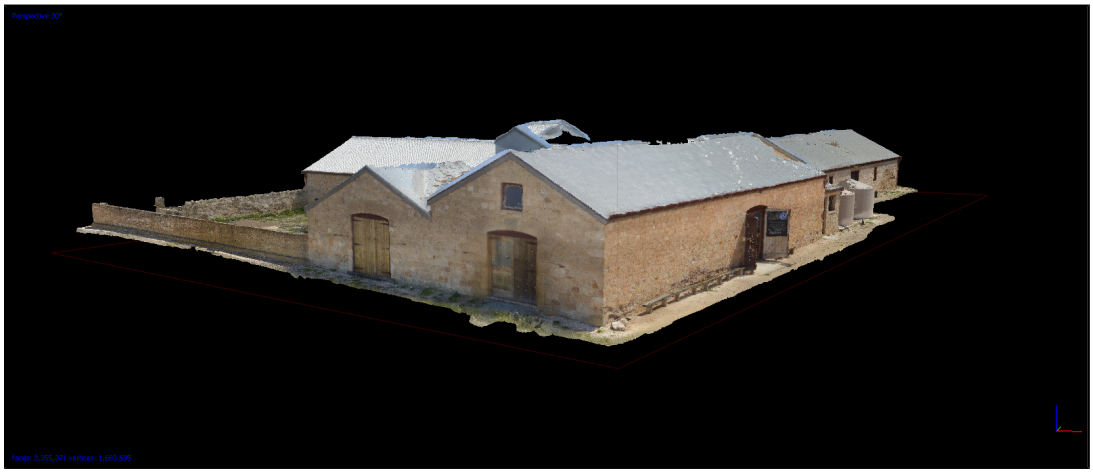

Figure 5.24: Photogrammetry model of the Woolshed viewed looking north

Figure 5.25: Photogrammetry model of the Woolshed holding yard viewed looking north east

Figure 5.26: Photogrammetry model of the Woolshed viewed looking west from an elevated position

Figure 5.27 shows the textured model of the island produced using multi image photogrammetry. The model clearly shows the relief of the limestone rock which the island is situated upon.

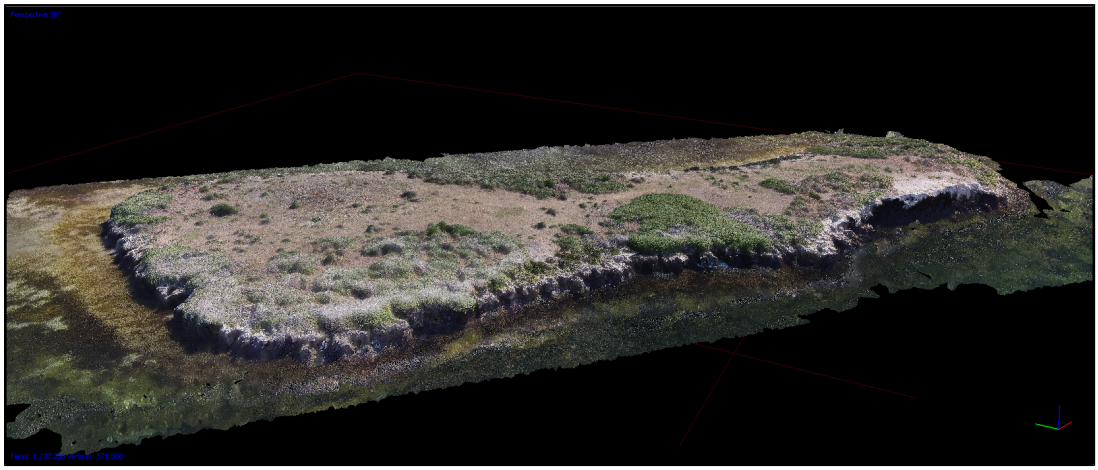

Figure 5.27: Photogrammetry model of the island near the Mount Dutton Bay Jetty viewed looking north east

5.5 Data Integration

Figures 5.28 through 5.32 show the photogrammetric models integrated into a single three dimensional scene with a variety of different data. Two dimensional data sources are overlaid on the elevation model interpolated from the total station data. Figure 5.28 shows the photogrammetry models with base satellite imagery of the area. Figure 5.29 shows an aerial photography orthophoto of the site. Figure 5.30 shows a three dimensional model produced by the aerial photography of the site. This includes any surface features including trees and buildings. Figures 5.31 and 5.32 show the historical surveys seen in figure 5.28 integrated with the three dimensional models seen from two different perspectives.

Figure 5.28: Photogrammetry models viewed together in unified 3D scene using ESRI base satellite image and elevation model.

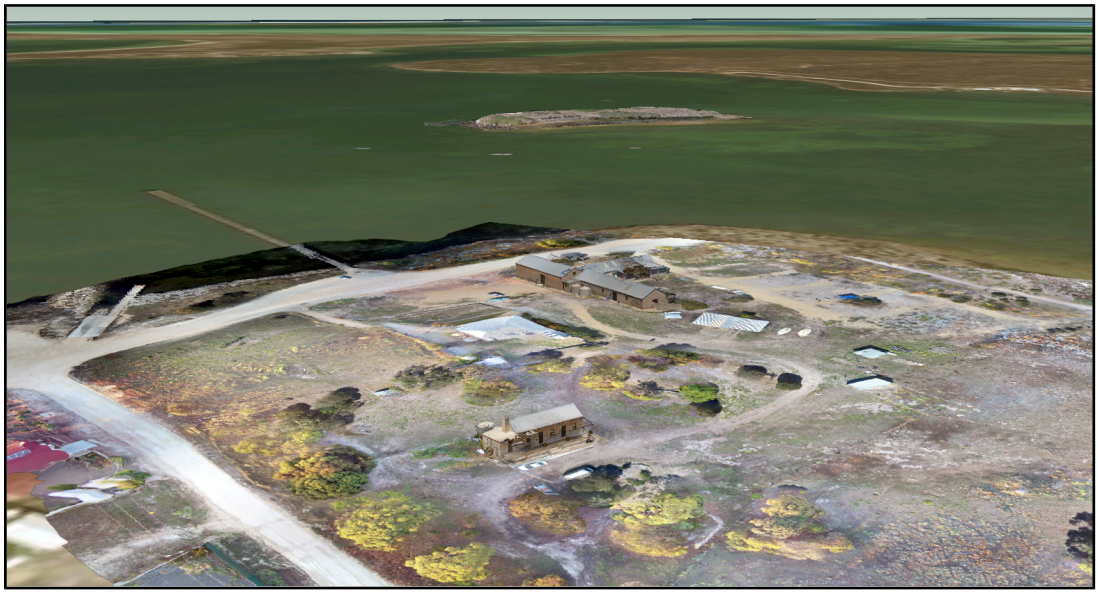

Figure 5.29: Photogrammetry models viewed together in unified 3D scene with aerial photography

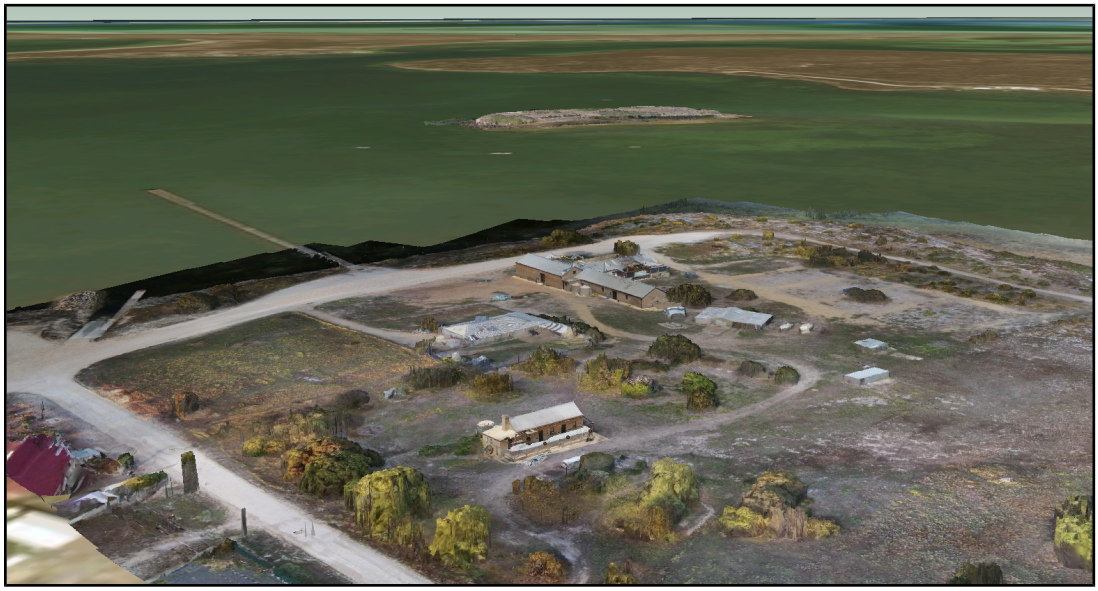

Figure 5.30: Photogrammetry models viewed together in unified 3D scene with photogrammetric model of terrain surface

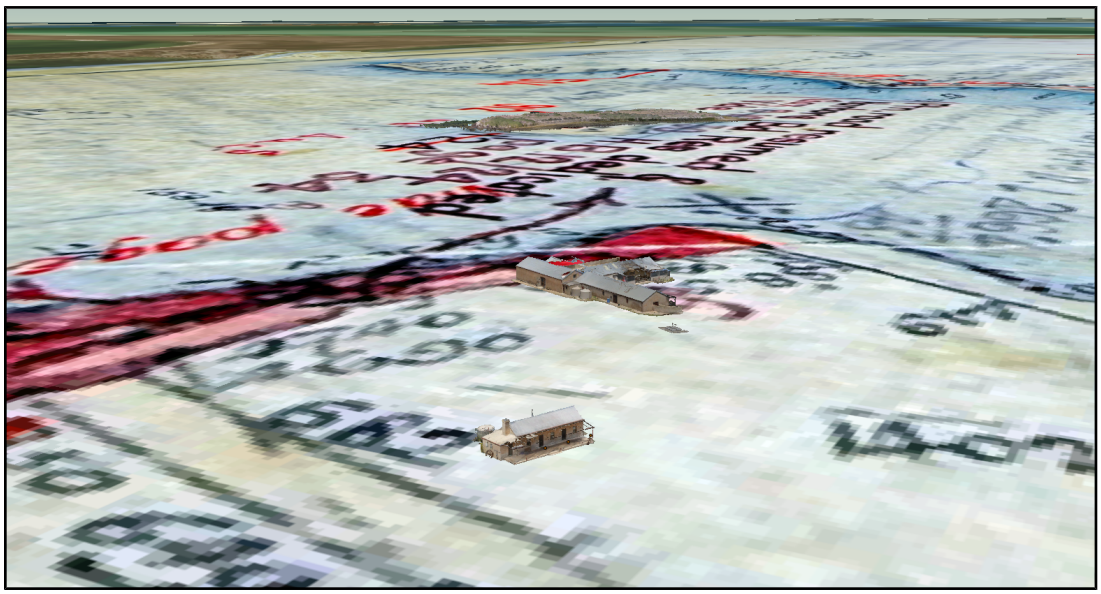

Figure 5.31: Photogrammetry models viewed together in unified 3D scene with georeferenced historic hundred survey map (1871)

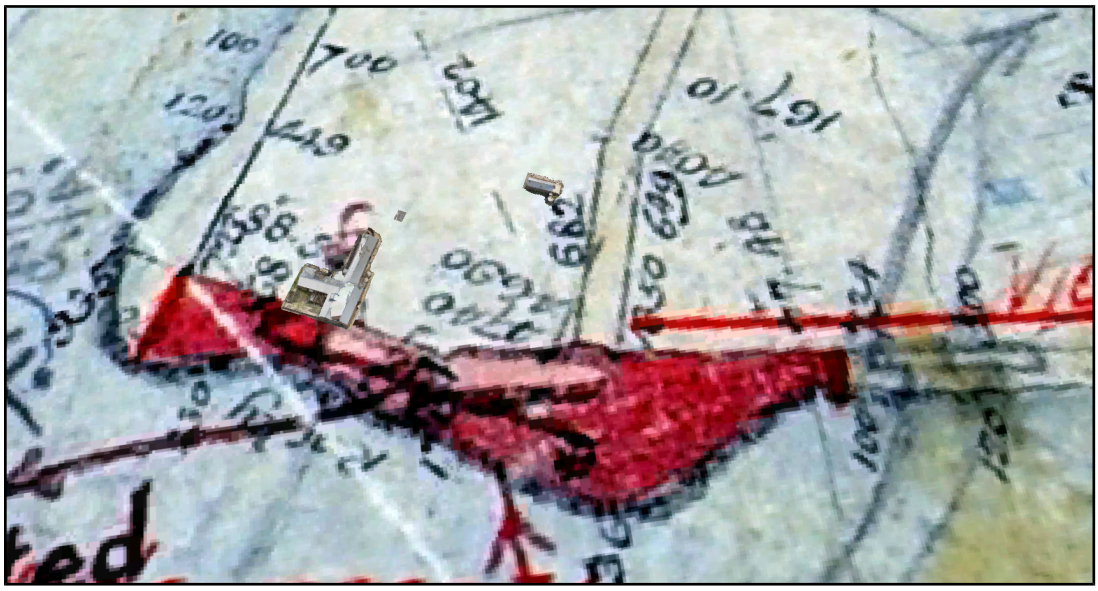

Figure 5.32: Photogrammetry models viewed together in unified 3D scene with photogrammetric model of terrain surface view looking north from elevated position

5.6 Visibility Analysis

Figure 5.33 shows the terrain model interpolated from the total station survey. Figure 5.34 shows the digital elevation model derived from the photogrammetric model of the aerial photography.

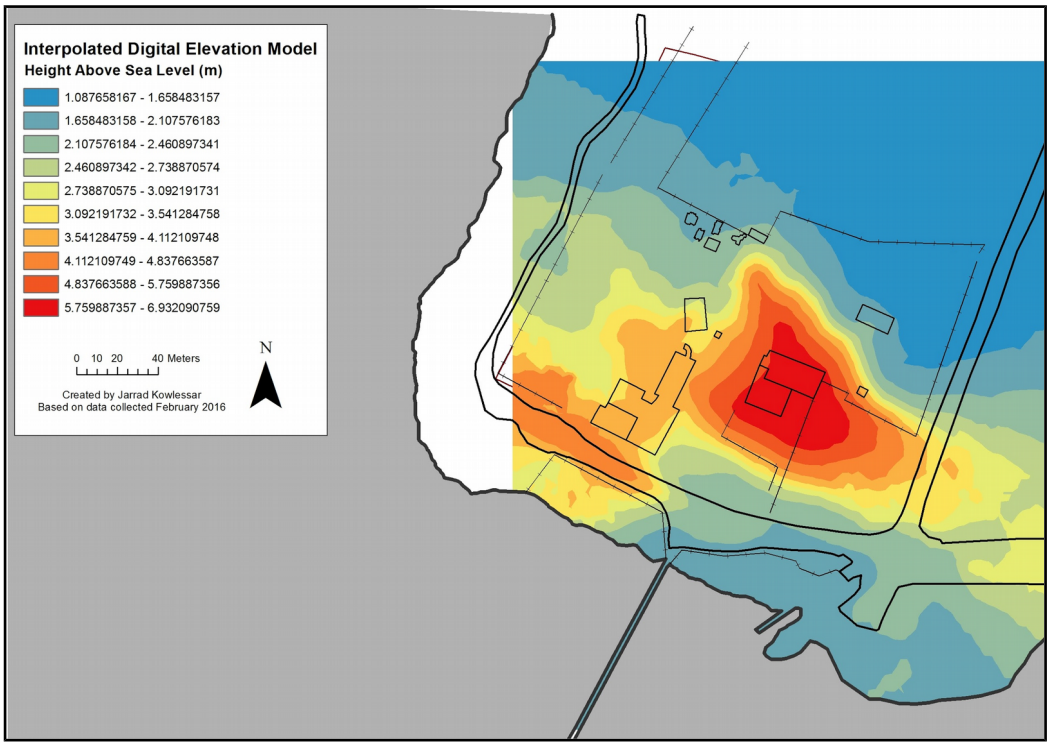

Figure 5.33: Elevation surface interpolated using ordinary kriging of total station survey data.

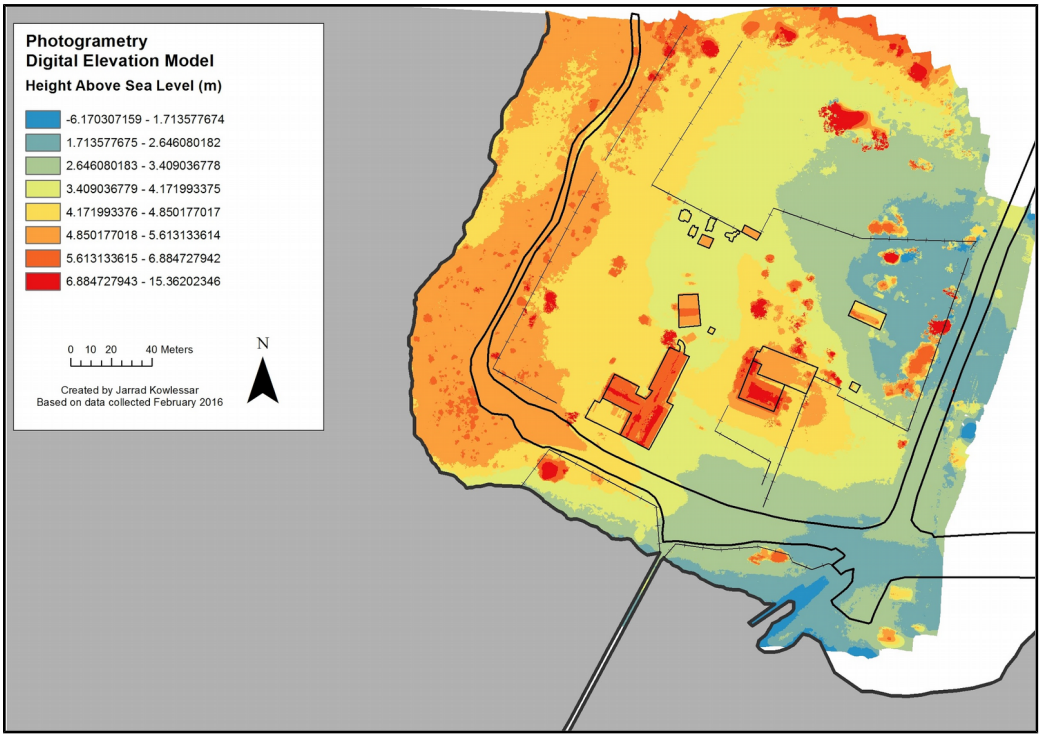

Figure 5.34: Elevation Surface generated using photogrammetric processing of aerial photography

Figure 5.35 shows a histogram of the surface elevations measured during the total station survey. 5.36 shows the measured error produced by the validation process of the kriging process. Figure 5.37 shows the standardised error for the kriging surface.

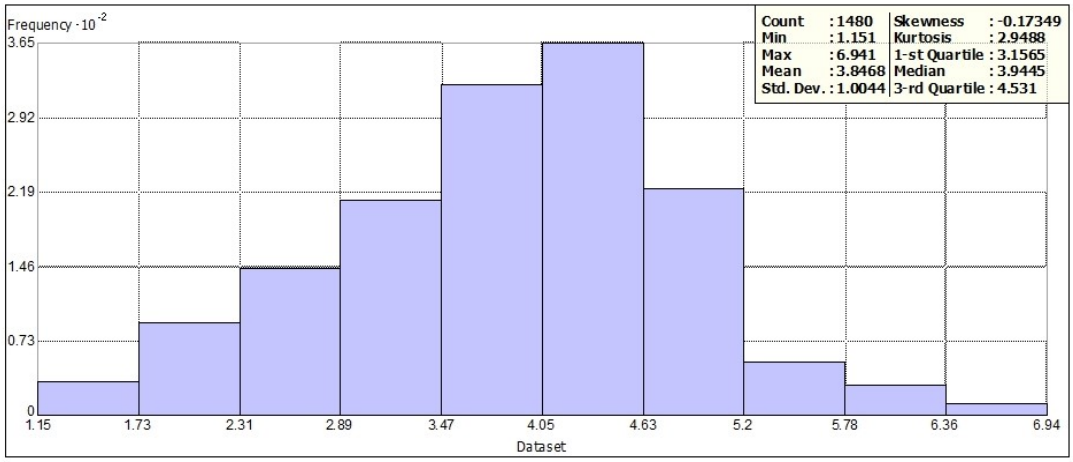

Figure 5.35: Total Station measured values histogram

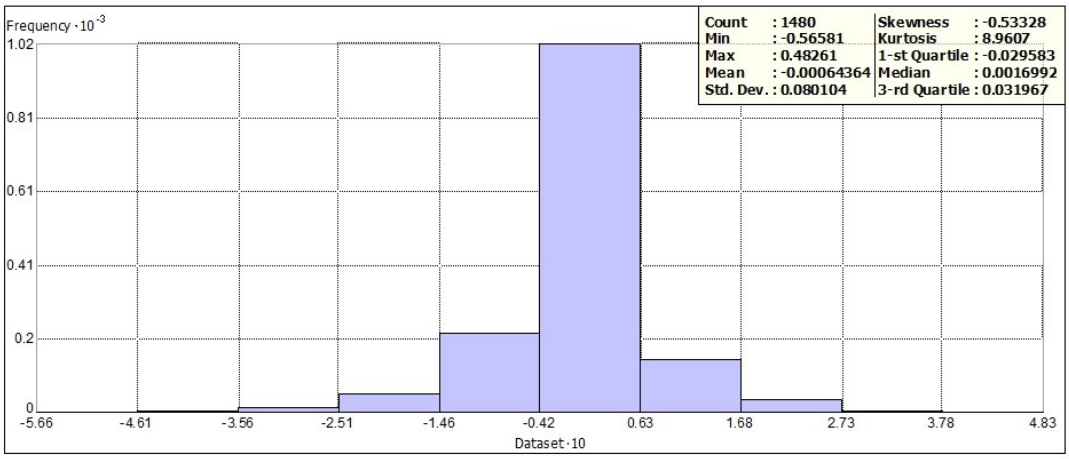

Figure 5.36: Kriging validation data: measured error histogram

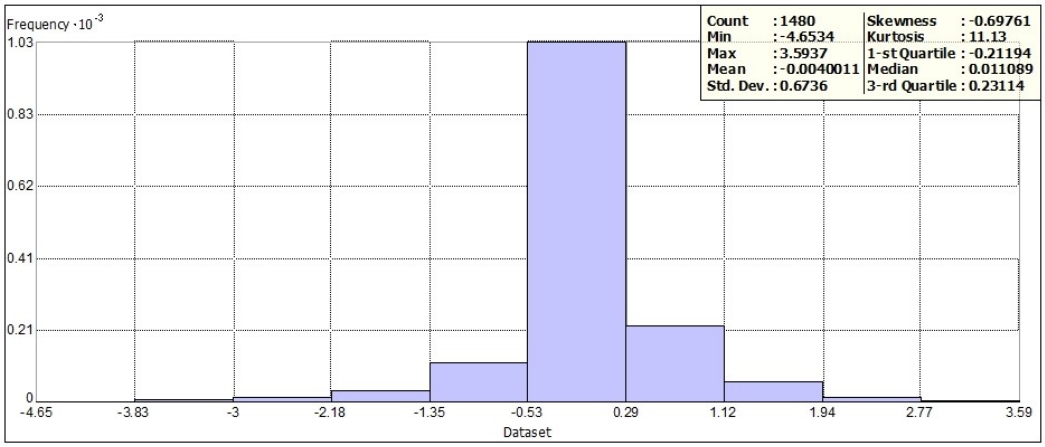

Figure 5.37: Kriging validation data: standardised error histogram

Figure 5.38 shows a surface displaying the difference between elevations predicted by the interpolated total station data and the DEM produced by photogrammetric modeling of the aerial photography. It can be seen that values close to zero difference are common in flat open areas and areas that are contain surface features not measured by the total station survey show large discrepancies. The difference in the area around the hill that was inaccessible to total station survey is mostly between 30 centimeters and 1 meter, with some areas as much as 2 metres difference. This error can be attributed to the coverage of the total station data.

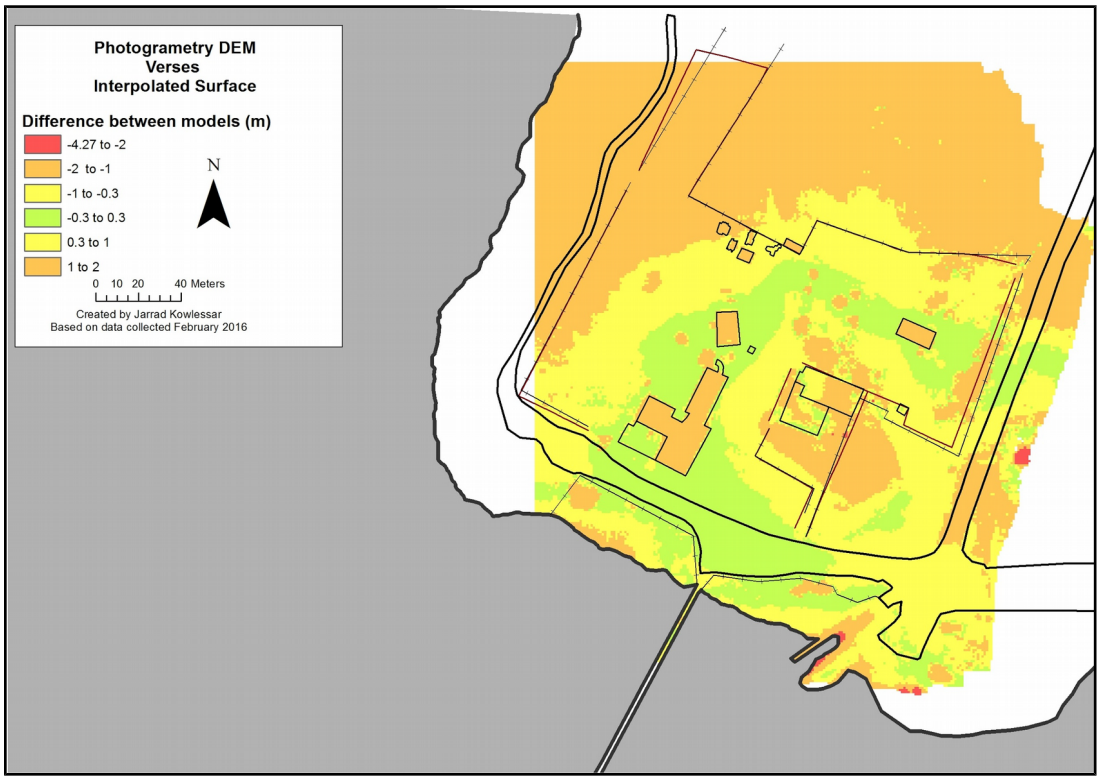

Figure 5.38: Difference surface showing difference between Interpolated DEM and Photogrammetry DEM

Figure 5.39 shows the results of the Visibility analysis displaying green for areas visible from the location of the cottage front windows and red for those areas that are not visible. This analysis did not include the model of the structures in the result so only occlusions from the terrain relief are shown. It can be seen that the neither the woolshed or ocean are visible from the location of the shearers' quarters.

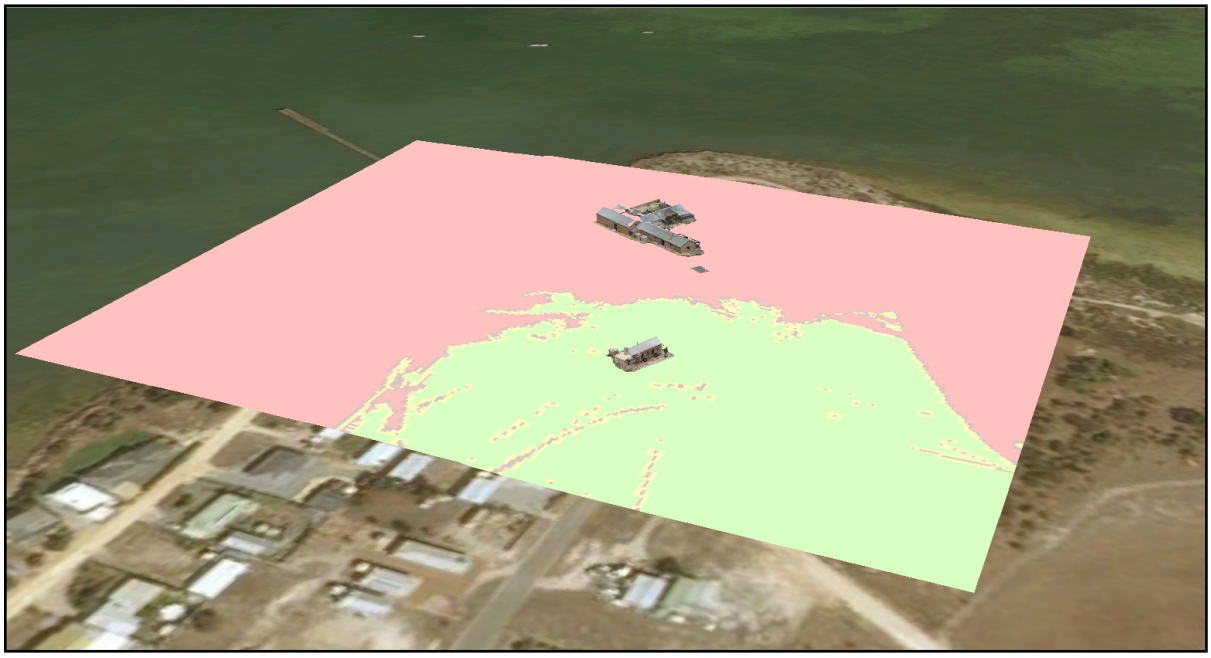

Figure 5.39: Visibility analysis of shearers quarters windows

Figure 5.40 shows a visibility analysis conducted to determine the height above ground level visibility from the shearer's quarters rear windows. The results of this analysis are shown in 5.41. Figure 5.42 shows AGL surface from the same widow points lowered to the 1.4 metre height observed in the structure recorded in Grguric's (2007; 2008) study.

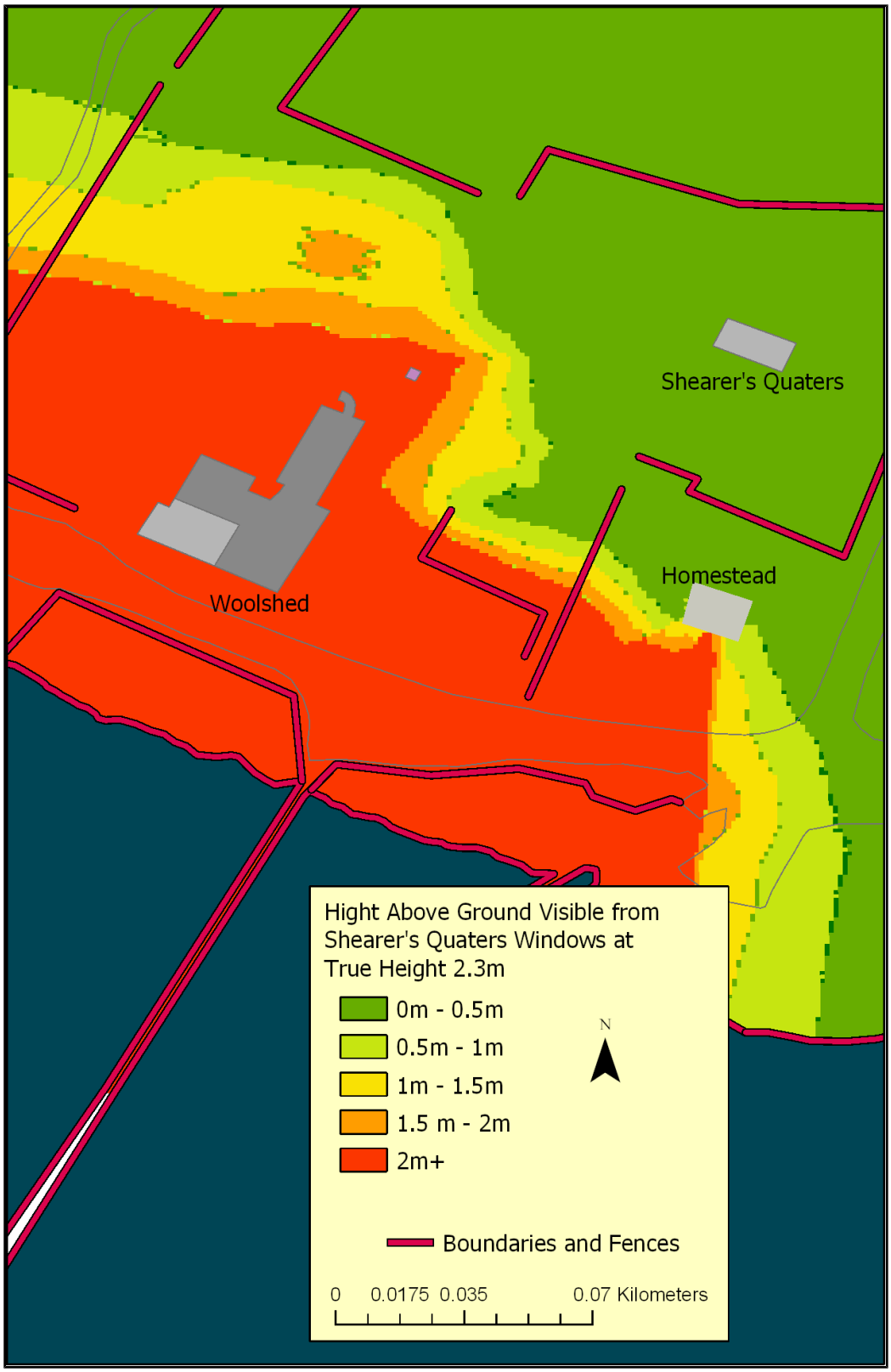

Figure 5.40: Height Above Ground Level (AGL) Visibility from Shearer's Quarters Rear Windows

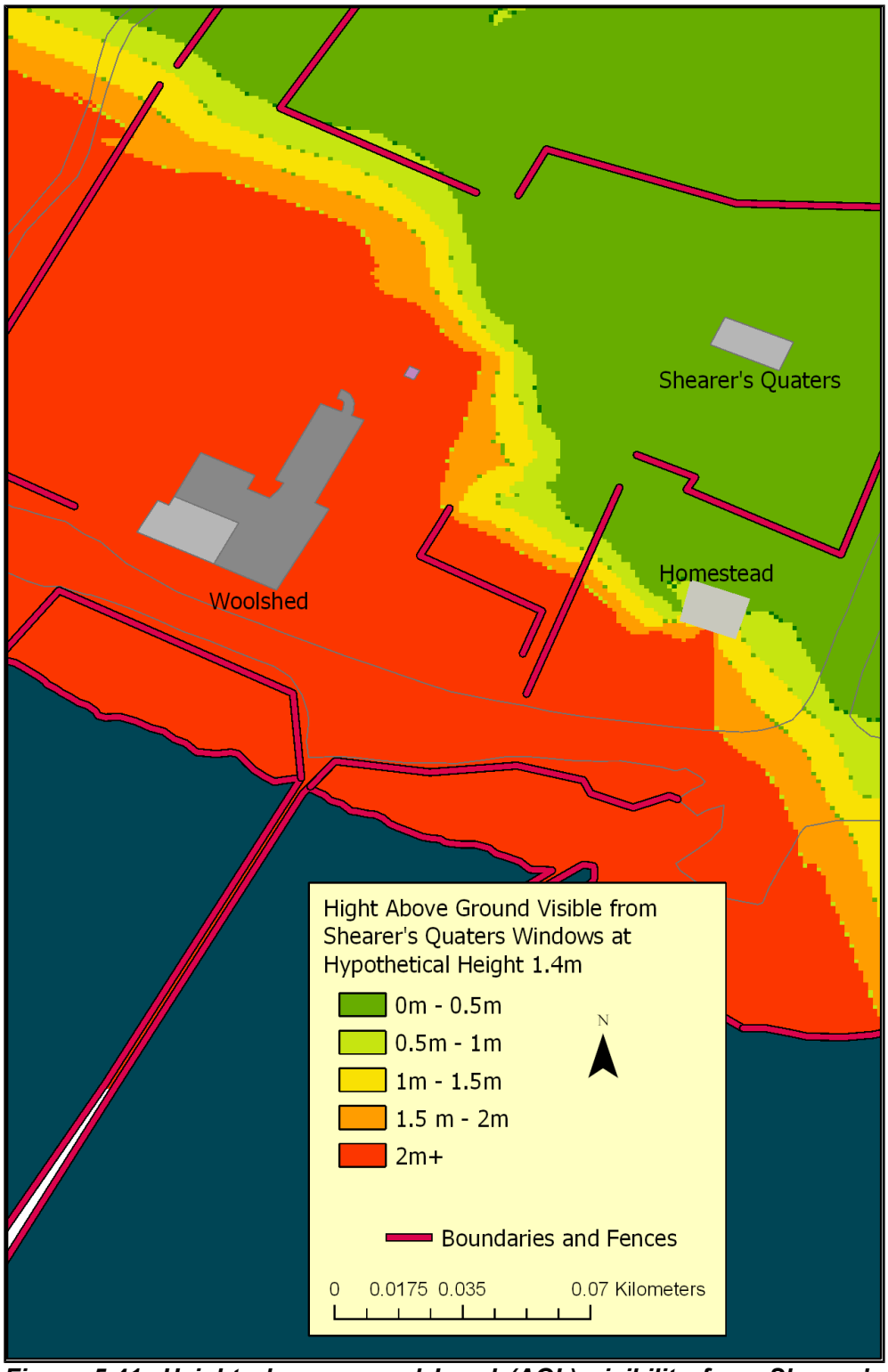

Figure 5.41: Height above ground Level (AGL) visibility from Shearer's Quarters rear windows, with windows at a hypothetical height of 1.4 metres above surface level of the building.

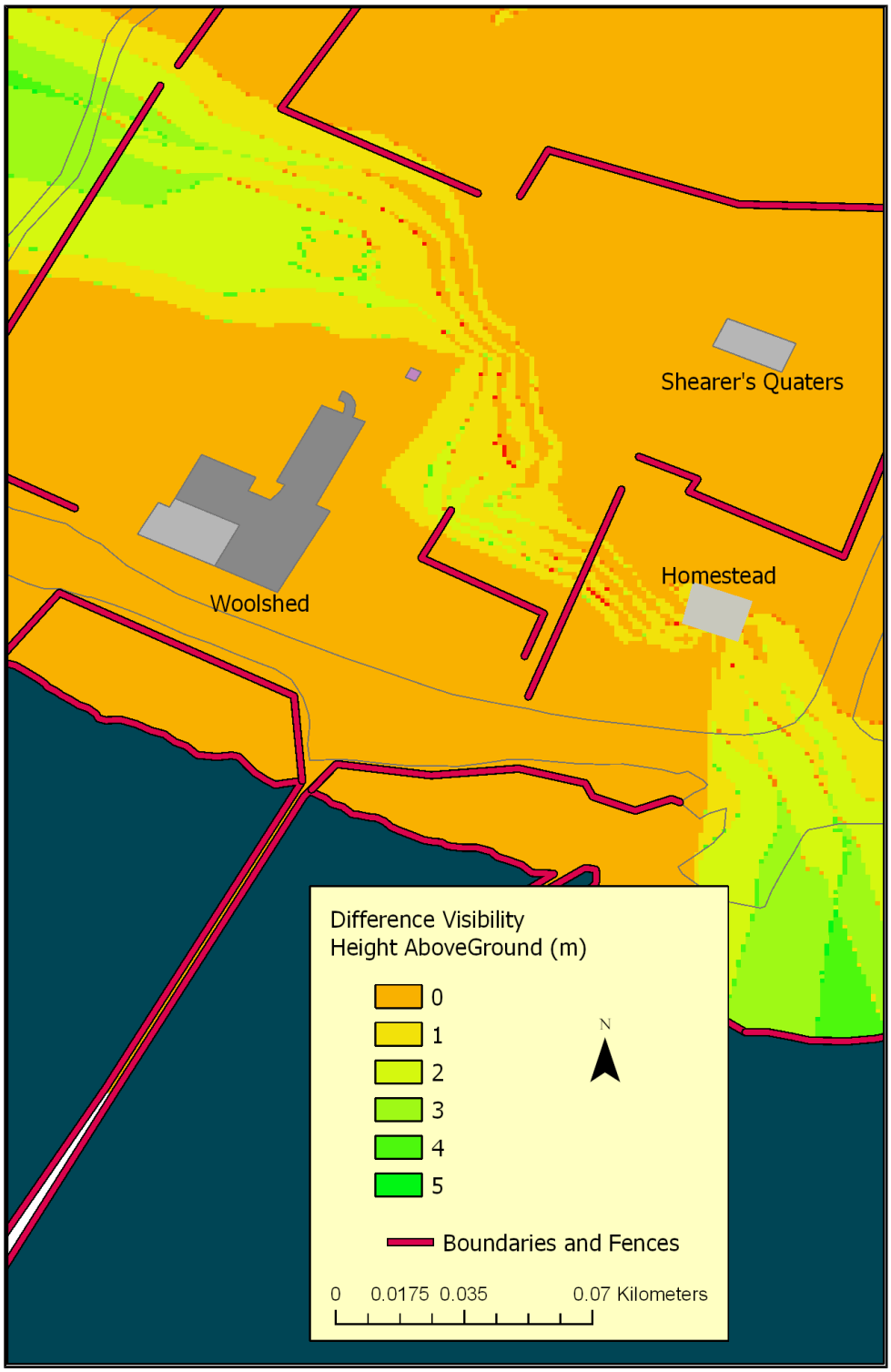

Figure 5.42: The difference in height above ground Level visibility from true window height of 2.3 metres and hypothetical height of 1.4 metres.

CHAPTER 6: Discussion and Conclusions

6.0 Introduction

This chapter discusses the results of the research with the aim to uncover past human attitudes and perspectives towards the coastal space that constitutes Mount Dutton Bay. The importance of perspectives is made clear by the literature reviewed in chapter two, which argues that coastal space can be seen as a unique union of terrestrial and marine areas, and that in such a space specific perspectives and cultural attitudes can be seen in past human activities. In this regard, the analysis and interpretation of the results of this research is conducted with three specific aspects of the site in mind which frame the discussion, namely; marine, terrestrial and coastal.

The use of these thematic categories firstly draws an interpretation of those activities that occurred on the site, largely validating those descriptions noted in the review of historical literature conducted in chapter three. Secondly, the discussion takes this model of site activity and interprets perspectives and attitudes visible in this account of past human activity with specific regard for coastal space. Finally, this chapter reviews the additional information provided by the three dimensional landscape approach conducted by this research.

Following, figure 6.1 shows the thematic categories selected to describe this site and demonstrates the nature of those categories.

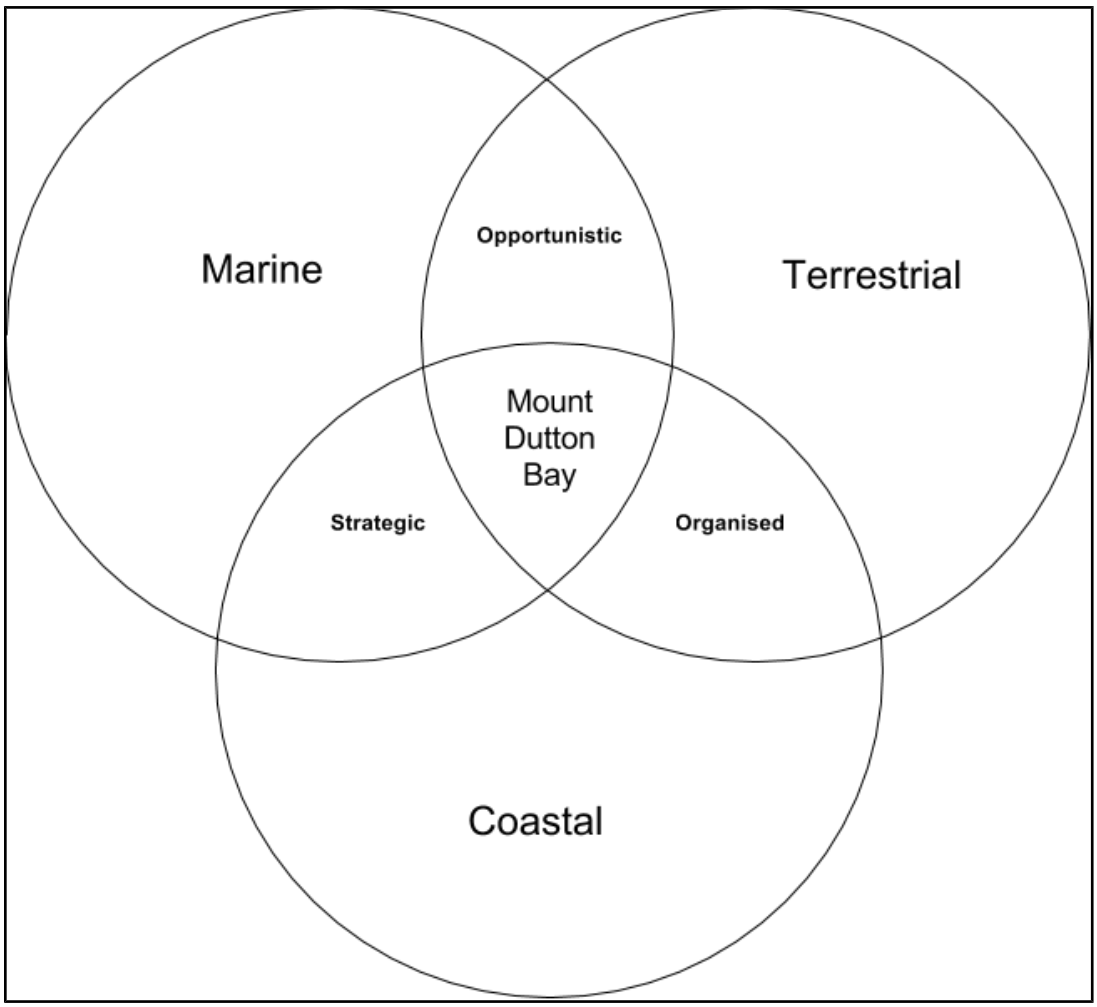

Figure 6.1: Interpretive Categories for Mount Dutton Bay

The marine category describes those human activities that occurred at, or with specific regard to the marine sectors of this site. The terrestrial category describes the land based activities and considerations observed in this study. The coastal category collects those issues, activities and considerations that specifically relate to areas that lie between and connect those marine and terrestrial environments. Examples of these activities and colonial considerations made visible throughout this research are provided in figure 6.2.

The union between terrestrial and marine sections identifies those considerations and issues that the two areas have in common. In this case, the opportunistic availability of resources and criteria for expansion have been observed, which will be further discussed and explored within this chapter.

The union between terrestrial and coastal space collects those factors that made specific use and consideration of the coast in order to conduct those land based activities described by the terrestrial category. Arguing that this union point describes those settlement patterns and colonisation approaches that made tactical use of the coast, the point of overlap is described in figure 6.1 as organisation.

The union between marine and coastal considerations has been used to describe those specific logistics and considerations that make use of the coastal area to capitalise on the resources and considerations given to the marine elements. This has been collectively described in figure 6.1 as strategies.

This describes the framework which will be used for interpretation of the results of this research.

6.1 Historical Validation

The history of the site is established in chapter three and paints a clear picture of a continuing narrative beginning from the early whaling and sealing through to the 1930s when the site was still an operational woolshed and harbour. The historical sources that describe this site, especially those that detail the woolshed's day to day operation are largely anecdotal and poorly referenced, relying on local uncredited oral histories. The data gathered in this research contributes towards validation of these historical descriptions in two distinct resolutions: larger settlement patterns and site selection, as well as local site activities.

The early expansion period of the Coffin Bay region is explained in the historical literature by a process that can be interpreted as geographic determinism, guided by the occupational leases implemented as part of the systematic colonisation scheme. This saw a period of prospection for suitable lands for lease for sheep and cattle in the region. Leases proceeded westerly across the peninsula towards Coffin Bay with some of the largest leases on the shores of the bay. The maritime industries were similarly guided by the resources of the bay and its abundant fishing opportunities, although at the outset, the maritime and terrestrial industries were separate.

The overlap of these two activities was most clearly driven by the need for supplies to be provided to the regional expansions on the west coast of the peninsula. The historical literature discussed in chapter three claims that the

lightering points were present in the sheltered Mount Dutton Bay before the jetty was constructed. The historical survey maps drawn in 1871 show landings along the eastern edge of the bay. These landing sites were reserved by the marine board in 1894 (South Australian Governmet Gazette, september 28 1911). This demonstrates the continued use of the bay and the value of the landing sites. These early maps indicate roads from the landing sites leading to the township of Lake Wangary which can be seen in figures 5.3 and 5.4. The roads to these landing sites clearly show a shorter commute from the bay to the township.

The establishment of the jetty supersedes and probably supplants these landing sites. Despite the jetty being government built the location was selected fronting privately owned property. This may suggest a systematic collaboration with Price Maurice whose woolshed became an integral part of the harbour facility. Detailed mapping of the elevations and aspect and geological features of the entire Mount Dutton Bay coastline, especially the eastern edge of the bay would be useful in further understanding the selection of the jetty's location. Furthermore, a detailed historical study of records regarding the construction of the jetty as well as oral histories collected from local residents of the region may shed light on its placement.

Regardless of the intention of the selection of its location, the jetty and woolshed can be seen to have made a complex of significant size and infrastructure somewhat separated from the town. The historical literature

describes the site as a centre of industry both maritime and terrestrial as well as a social hub making use of both the associated population as well as the sites infrastructure. In this regard the location and facilities of the site strongly support this claim.

6.1.1 Surface Surveys

The surface surveys predominantly provide presence and absence data of a highly disturbed surface. This provides useful information for interpreting the site and validating the interpretations drawn from the written histories of the site. However, before interpreting this data it's important to remain mindful that many materials have been removed from the site for a private collection intended to showcase the site’s history. This collection is therefore biased by the removal of those materials previously judged to be significant indicators of the site which consequently have been curated according to unspecified requirements. In this way the bias is passed on to the thesis assemblage as it must comprise only materials unnoticed or deemed to be insignificant or unwanted by the previous collector. Another consideration to interpreting the data is that individual glass shards were recorded individually when observed in isolation. The frequency of glass observed therefore does not necessarily demonstrate the frequency of glass objects that can be counted on the site as many shards may be large scatters of the original broken object. For these reasons, although being arranged in histograms for simple visualisation, the

frequencies of these artefacts cannot be directly compared. Instead this assemblage provides data to interpret the parameters of the site and the types of activities that occurred there.

Although much of the specific material culture cannot be definitively separated from general household items, the data does indicate a social nature of the site when considered in the context of the historical anecdotes. In this light, the ceramics observed around the cottage may well support accounts of a tea shop run on the site, acting as a social centre that serviced farmers making use of the jetty (Casanova 1992:170; Puckridge 2016).

Indeed, the 3D archaeological data supports the historical anecdotes of a tea shop run from a room grafted onto the shearers' quarters with the seam of its attachment clearly visible in the photogrammetric model of the building, behind what was the original fire place (see figure 5.19) (Casanova 1992:170). Although the story of this room being used as a teashop cannot be definitively validated by this data, the abundance of ceramic materials present around the cottage, many including decorative printed patterns, certainly adds additional support to this claim.

6.1.2 ‘Guano’ Island

The island is located very prominently and is in direct visibility to the site. The location of the island is extremely accessible from the jetty, however is far

enough away to provide privacy and shelter to bird populations. As historical anecdotes noted the prevalence of guano on small islands around Mount Dutton Bay (Casanova 1992:41), this island fits that description perfectly.

The surveys conducted on the island show some human activity occurred on the island. Although glass was prevalent in all areas surveyed, the only instances of fully intact bottles found were on this island. This can be explained by the island's separation from the mainland, with activity therefore far more limited than on the rest of the site, perhaps ceasing entirely once guano collecting here lost its popularity. The island has a high relief making it unlikely that the glass found on this island, especially in the central regions was deposited by tidal activity. Other artefacts noted in the survey include items that also could not have been deposited by tidal movement due to their material composition, such as a large heavy metal sheet.

For these reasons the surface surveys alone support accounts of notable historical activity occurring on this island. Three fence posts were observed, some entangled with fencing wire. This may suggest that the activities on this island exceeded the accounts of guano mining and may be extended to some type of land management or access restrictions. The noted modern bird population and associated guano deposits strongly support the claims that the island was used as a guano mining site, and the resulting limited ground visibility may have concealed further finds, suggesting that future investigations may be rewarding.

6.1.3 Infrastructure

The built heritage recorded at the site demonstrates those historical claims of the grandeur of the woolshed, and the associated maritime infrastructure shows the clear relationship between the two. The recorded railway which extends from the woolshed over the jetty shows that these two structures were built to operate together. In this way, as the jetty was the primary port to supply a large surrounding region, the woolshed can be thought of as a central facility in the region. It is not surprising then, that such a central point, or hub, of import, export and industrial activity for all major industry in the region, both maritime and terrestrial, intrinsically developed a community and social landscape.

6.1.4 Analysis

The field observations and historical data together paint a quite detailed and nuanced picture of the site. Figure 6.2 shows how these separate description of the site activity, determined from both the archaeological and historical analyses, can be viewed and understood together based on the interpretive framework described at the beginning of this chapter, section 6.0.

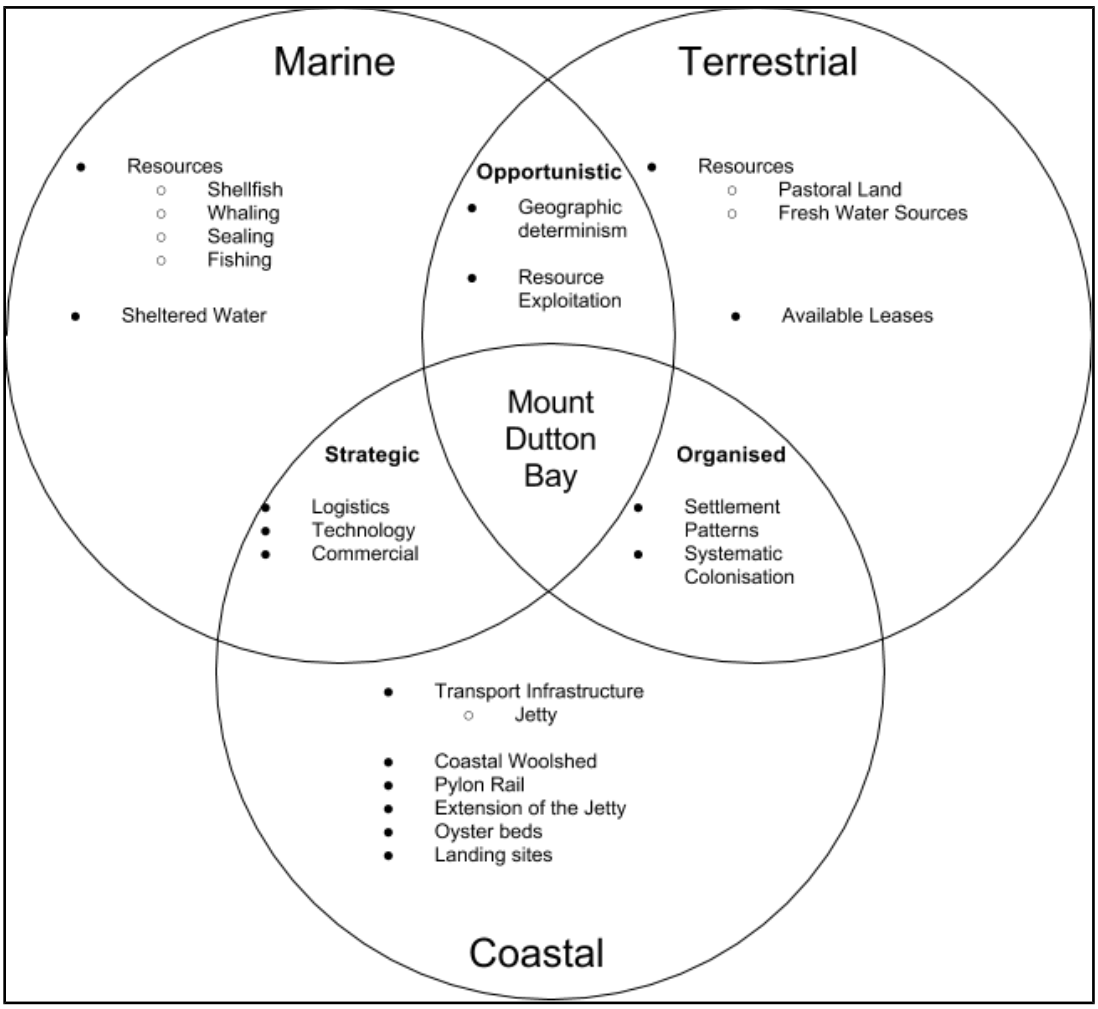

Figure 6.2: A description of the Mount Dutton Bay

The marine activities of the site, extending into the larger bay area, have been driven by resource availability. Even from before the colonisation of the state, the region was targeted for whaling and sealing, and this pursuit of resources continued with the Coffin Bay oysters and fishing industries. Before any terrestrial colonial settlement in the region, the maritime occupations brought about the construction of 'Oyster Town' as discussed in chapter 3 (Page 36). Although this was a coastal settlement, this research found no record of any inland endeavours at the time, and all access to this

community seemed to have been maritime in nature. Therefore, even this tactical use of the coast can be seem to be dominantly marine in nature, with later terrestrial interconnections not present until land based settlement in the region. This further demonstrates that the activities in the region were heavily lead by maritime resources.

Similar to the maritime activities, the pursuit of resources can be seen as the driving force for future land based activities. These activities can be argued to have been economically driven, expanding in search of resources to support primarily pastoral enterprises. Such resources identified are suitable grazing land and freshwater sources. Secondary factors include the availability of leases and site accessibility. The presence of an established waterborne trade route providing export facilities was quickly expanded to facilitate the land based industries.

In regard to accessibility and connection to the larger colony, waterways were clearly a major factor. In this regard, the legislative control of those waterways, seen in both the management of resources such oyster beds, and the government control of landing sites and eventual construction of a jetty, can be seen as an organised approach to this regional expansion. This organisation clearly made great use of the coast as a means of connecting the area, and worked with later terrestrial expansion so as to connect these far away leases.

This organised use of the coast made strategic uses of specific coastal spaces which in many cases provided unique opportunities. One example is the use of the sheltered waters of the Coffin Bay complex. Whilst the historical records show that supply to the area may have originally been through the outer waters of Farm Beach, the eventual move into the bay shows a strategic capitalisation (Puckridge 2016). This coupled with the shallow draft of ketches and oyster cutters, created the suitable port in Mount Dutton Bay.

These findings reach agreement with Khan's (2006) research, and support the description of an economically led expansion into this region. By expanding the research from a focus on port related structures, the view of the pastoral region was uncovered by this research, and demonstrates a more detailed account of this economic expansion. Whilst in an account of the settlement patterns reaches agreement between Khan's approach and this research, the strength of the landscape approach, and particularly the 3D visualisation approach is best demonstrated through an explorations of the attitudes that accompanied these clonal expansions beyond a simple pursuit of resources.

6.2 Attitudes

To explore attitudes towards the coastal space, argued previously to have been occupied for strategic use in the pursuit of economically driven expansion, the entire site needs to be considered in detail. To do this, the structures and use of space are the focus of this research. The structures and their relationship to the topography of the area are put into view through the scene compiling 3D models of the structures and the terrain. With the contemporary buildings and trees removed from the scene, a more accurate view of the original landscape is created. When considered in this way, the position of the structures as they are sited, in relation to the coast, the local topography, and to each other, can be considered free of contemporary distractions.

The first indication is clearly that the location of the woolshed is primarily situated to take advantage of the jetty and vice versa. This is a simple restatement of the existing historical documentation. However, this view also draws some attention to the location of the shearers' quarters. Situated on the far side of the hill, the shearers' quarters is isolated from the other structures that make up the complex. This isolation may indicate some of the more nuanced values and considerations faced by those pastoralists who first designed the layout of this site.

Purchased from the crown by Price Maurice in 1871, the land under investigation was previously only occupied under the pastoral leases, which

Price Maurice also held. The woolshed was constructed in 1875 and positioned to take advantage of the coastal landing point, at which point the jetty was constructed soon after in 1881. The change from land lease to land ownership no doubt presented Maurice with the first opportunity to make major developments such as to erect the woolshed, without risk that the land will be purchased out from under him when his lease expired. The date of the construction of associated shearers' quarters, and the homestead which is no longer standing, are unknown, although the shearers' quarters is believed to have been constructed at the same time as the woolshed (Puckridge 2016). The homestead may have already existed, developed for property managers when the land was leased for grazing.

Regardless of the order of construction between the woolshed, shearers' quarters and the homestead, the positions relative to each other would have been considered at the time of construction. Regarding the Shearers' quarters, the visibility analysis shown in figure 5.39 in chapter 5, demonstrates that its location has no view of either the ocean or the woolshed. This visibility analysis was conducted without consideration of any obstructions, and so offers a 360° view of the surroundings, demonstrating that before its construction, the limitations of view were evident to those who chose this location. The choice to build this structure at this particular site and orientation will be discussed with considerations from three major perspectives derived from the literature review and history of the site: a consideration of class based separation of living space, a distinct separation

of working space and living space and finally an exploration of the fortified structures hypothesis put forward by Grguric (2007).

6.2.1 Class Separation

Although the building is no longer standing, the homestead can be seen in figure 6.3**.** The archival research has produced no date for the original construction of the homestead, however as the property was already leased by Price Maurice, it is likely that the structure was built by his direction. Whether the structure was built and used by pastoralists working this area before it was a shearing station, or whether it was purpose built to accompany the woolshed complex is unclear, however both possibilities demonstrate that the structure was a much more permanent residence than the shearers' quarters. Whilst the shearers' quarters was a temporary, seasonal residence for many shearers who used the shed to process their wool, the homestead was likely a permanent residence for the property manager.

The images in figures 6.3 and 6.5 show that the homestead's front windows faced towards the water, while the rear wall has no visible windows. The shearers' quarters front windows face inland, therefore the two structures are back to back facing away from one another. This may indicate some pursuit of privacy in the design of this layout. The homestead appears to be larger

than the shearers' quarters and faces towards the bay with an uninterrupted view of the water. The homestead, being a larger structure, likely to have been occupied by a property manager acting as landlord or authority towards the temporary users of the woolshed, may further indicate a value given to the ocean viewpoint, afforded to the homestead which, as such, can be interpreted as an indication of class separation on the property.

As Maurice had control of a large parcel of land, many locations even an equal distance away from the woolshed could have been chosen for the site of the shearers quarters, many of which have ocean views and even afford the same privacy from the homestead. The choice to place the shearers quarters on the far side of a hill in one of the only locations to have no view of the water may therefore be considered deliberate.

Figure 6.3: Aerial photo showing the position of the homestead before its demolition [Removed due to copyright restrictions]

6.2.2 Separation of Living and Working Spaces

A second possible interpretation for the placement of the structures may be related to working space. The shearers' quarters has been demonstrated to have no view of the woolshed, despite this being the primary working station for any occupants residing at this location. This may indicate a deliberate separation of living and working space. The limited number of published surveys of the spatial arrangement of stations on the Eyre Peninsula,show a comparison is possible when made with the work conducted by Grguric (2007, 2008). Grguric's research into another earlier station owned by Price Maurice shows a similar site layout, with the 'men's hut' which was used a workers' accommodation strikingly similar to the shearers' quarters at Mount Dutton Bay. Figure 6.4 shows the men's hut recorded by Grguric (2007:146) on Price Maurice's 1856 property near Sharinga, followed by figure 6.5, which shows the shearers' quarters at Mount Dutton Bay in 1980 before restorations were made to include the verandah.

Figure 6.4: The front of the Men's hut at Central Outstation (Grguric 2007:146)

Figure 6.5: The front of Mount Dutton Bay Shearers' Quarters with the homestead visible in the top left of the image (Coxhill et al 2006:42)

To explore the hypothesis of a deliberate separation of working space and living space, the aspect of the men's hut from Central Outstation must be considered, with figure 6.6 showing the layout of the Central Outstation site (Grguric 2007:151).

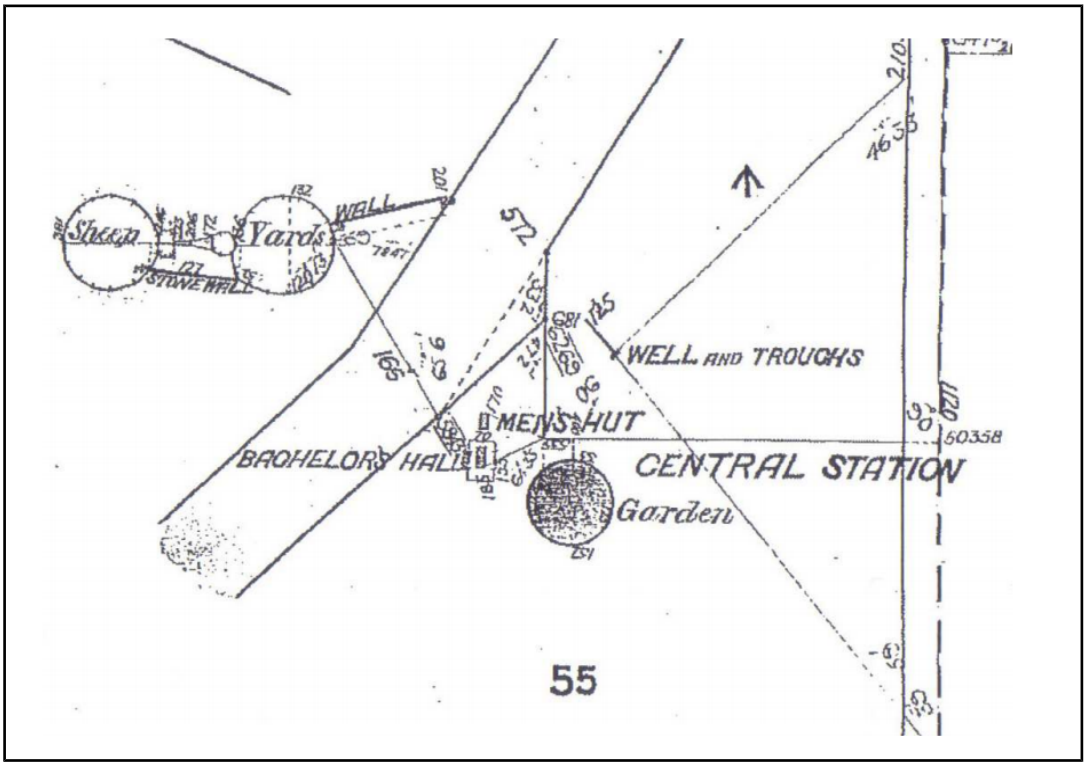

Figure 6.6: Layout of Central Outstation presented by Grguric (2007:151)

On the Central Outstation site, the men's hut is facing away from the sheep yards and a garden is shown on the site plan in front of the hut. (Grguric 2007:170; Grguric 2008: 76). This supports the argument that a tendency among the pastoral properties of the Eyre Peninsula may have been to separate working and living spaces, and this separation can be seen in the aspect and visibility from the large front windows of the residential structures. This comparison is only a very limited source of information and further surveys of pastoral stations among the peninsula and in particular along Price Maurice's runs could be important to further understanding this phenomenon.

The argument that there was a deliberate separation of working and living

space, especially in regards to the areas visible from the large front windows that are common among the early pastoral structures (Grguric 2008:69), cast some further implications on colonial attitudes towards coastal space visible in the archaeological record of Mount Dutton Bay. The shearers' quarters is not only positioned with no view of the woolshed but also with no view of the waters of the bay itself.

The entanglement of maritime and terrestrial cultures at this coastal site is well established by both the local history as well as the literature on coastal archaeology more generally (Ford 2011a, Ford 2011b; Westerdahl 2011). That the woolshed was designed to operate in conjunction with a jetty is evident by its location and the inclusion of a rail track used to transport wool form the shed to the jetty. If a separation of working space and living space is present in this site, it is therefore logical to conclude that this separation included the water of the bay as part of the working space for those shearers dwelling at the cottage. This indicates that the attitudes towards the maritime space may not have been simply notions of adjacency, but the shearers may have felt themselves to have maritime occupations at this coastal node. This further demonstrates the arguments of overlapping cultural landscapes present at coastal sites (Ford 2011a).

6.2.3 Defensive Landscape

Grguric's (2007; 2008) argument, discussed in chapter three, suggests that the structures of pastoral stations presented in some cases defensive modifications to protect from attacks from the Indigenous population of the region. This implies a further landscape of fear and fortification present on these colonial spaces. In Grguric's study of the men's hut at Central Outstation, small windows were built into the rear of the structure. One local historian's interpretation was that these windows were designed for defence, offering a vantage point for rifles to fire through (Baillie 1978: 134). Similar small windows are also present in the shearers' quarters at Mount Dutton Bay. Figure 6.7 shows the rear wall of the men's hut at Central Outstation and the following figure 6.8 shows the rear wall of the shearers' quarters at Mount Dutton Bay.

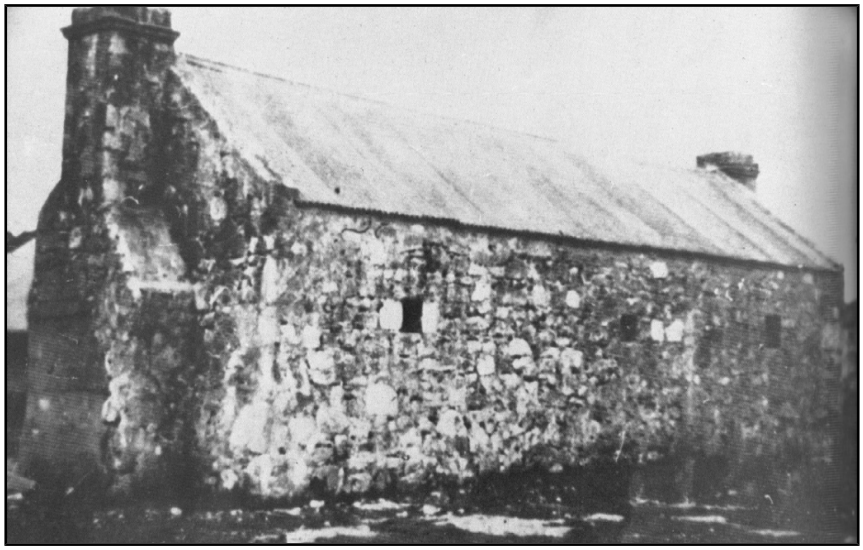

Figure 6.7: The west facing wall of the Men's Hut at central outstation (Baillie 1978: 134)

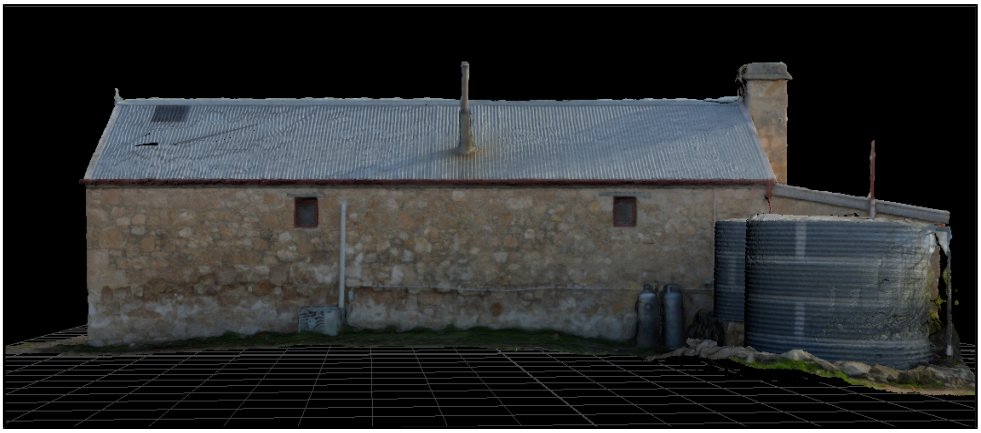

Figure 6.8: 3D Model showing the south facing wall of the Shearer's quarters at Mount Dutton Bay

Only two windows appear on the shearers' quarters rear wall whereas three were included in the men's hut. Despite this difference the presences of these windows show an extremely similar modification to the otherwise typical European style cottage (Grguric 2008:69). In addition of the number of windows placed at the rear of the structures the heights above the ground level of these windows varied greatly. The men's hut at Central Outstation recorded a height of 1.4 metres whilst the shearers' quarters windows were measured at 2.3 metres high. Figure 6.8 shows the windows of the two structures.

Figure 6.9: Rear windows of Central Outstation Men's Hut (left) and 3D model of Mount Dutton Bay Shearers' Quarters (right)

The height difference can be seen both relative to the ground and the ceiling and compared to the central front windows the windows of the shearers' quarters are raised beyond the height to function as typical aesthetic windows. Grguric's interpretation can be individually assessed for the shearers quarters. Grguric argued that the placement of the structure was to provide protective weapon cover to the sheep yards which he identified as the primary target of any raids on the Central Station property.

The visibility analysis (Figures 5.39, 5.40 and 5.41) conducted on the Mount

Dutton Bay structure showed that the only asset in view of the rear windows of the shearer's quarters was the original homestead. If Grguric's defensive interpretation is accurate for these windows then, this would suggest that the homestead was viewed as the primary target of raids on this property. This is a significantly different feature to the sheep yards that were being defended at Central Outstation, however no similar structure to the homestead was present at Central Outstation.

In the case of Mount Dutton Bay, food stores and resources would only be permanently present at the homestead, as the sheep population at the woolshed was not a permanent feature. Rather, a flock would come to be processed and leave not being stored for long periods of time as may be the procedure in the yards at Central Outstation. In this regard, the valuation of the homestead as a primary target is fitting with a defensive interpretation for the site layout. Indeed, the AGL visibility analysis of the shearers' quarters rear windows shows that a good coverage of the rear of the homestead could be offered. The AGL surface shows that a good portion of a person could be visible when standing at three of the sides of the homestead.

Interestingly however, when the same AGL was conducted from a height of 1.4 metres to match the windows at the Central Outstation site, this coverage was notably reduced. The exact differences, shown in figure 5.42, demonstrate between 1 and 2 metres of improved visibility around the homestead by having the shearers' quarters windows at their raised height.

This strongly supports the defensive interpretation, as the Central Outstation site was on flat ground and had no need to raise the windows for the same coverage, whereas the Mount Dutton Bay shearers' quarters would be defending a structure on top of a hill and benefits greatly for the raised windows in this regard.

Whilst the Central Outstation Site is not directly comparable to the terrain of this site, another site in Grguric's research, the Mount Benson homestead in the south east of South Australia may provide additional parallels (Grguric's 2007). This homestead has what Grguric argues to be a small rifle port-hole in the normally blank rear wall of the homestead. This aperture faces directly onto a raised mound. This aperture was not raised as were the windows of the shearers' quarters, however it can be seen that this mound was much smaller and did not exceed the height of the building. This means that the standing height of this aperture could cover the entire surface of the mound. Figure 6.10 and 6.11 shows the coverage of this mound.

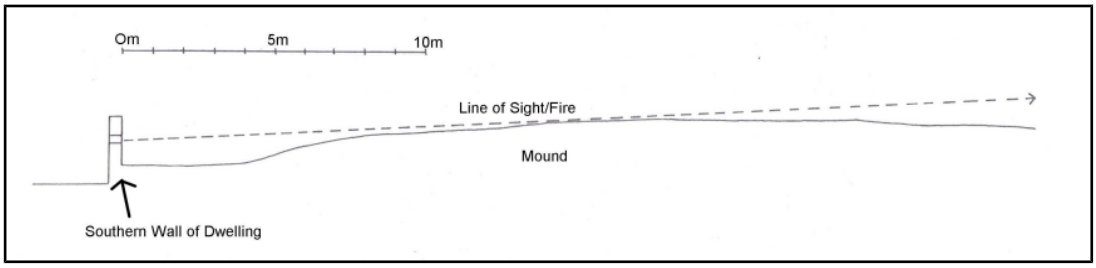

Figure 6.10: The coverage of the mound behind the Mount Benson Homestead (Grguric 2007:134)

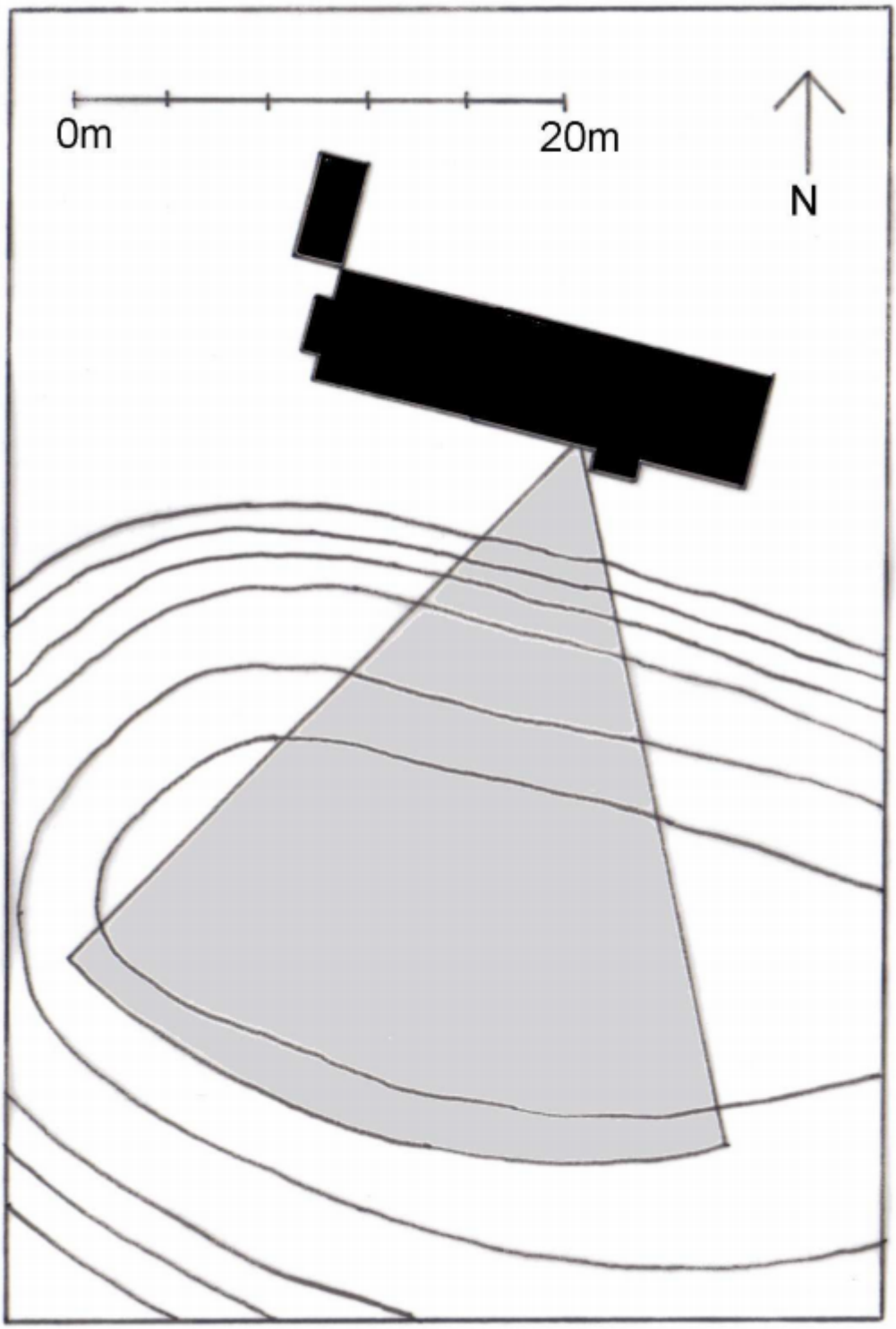

Figure 6.11: The arc of fire coverage of the mound behind the Mount Benson Homestead determined by Grguric (2007:135)

Based on the height of the mound, the raising of the aperture may have been considered unnecessary. As the hill behind the shearers' quarters at Mount Dutton Bay is more highly elevated, the necessity to raise the windows becomes more obvious. Alternative explanations for these windows and their raised height are limited, as these windows are south facing and so raising their height will not allow sufficient extra light to explain their position.

Grguric included as counter argument for a defensive interpretation, the 1856 date of his site being quite late in the narrative of frontier conflict and likely past the point of major attacks. This is especially true for the Mount Dutton Bay site which was constructed in 1875, a further twenty years later. If the defensive interpretation holds true, this indicates that a mindset of defence, fortification and fear were much longer lasting than previously thought. It is possible that a tradition was established to setting up new sites where defence was a built in consideration. Given the long history of conflict in the region and the personal experiences of Price Maurice, which did stretch back to the time of frontier conflict, a long lasting defensive strategy in consequent site and structure plans seems possible.

6.2.4 Overview

This research has shown three interpretations of the data which all hold some indication of the attitudes towards this coastal space held by the

colonists who built this complex. Each of these points has been grounded in the data produced through a holistic landscape analysis. Together, these interpretations and associated arguments paint the picture of many overlapping landscapes within the minds of the colonists. The research has indicated that the landscapes colonists navigated at Mount Dutton Bay included, but were not limited to, class based hierarchies, separations of working and living spaces, as well as foundations of fear and fortification. An intrinsic link between the land and sea has also been revealed, not only in the functions of the site, but also the mindsets of those who worked in this space, permeating a maritime culture that reached even the terrestrial based industry of shearing. No one of these interpretations is likely to be the one explanation of the use of space at the site, rather together, they form a description towards the complex attitudes towards this space, which combined to create the site.

6.3 Review of Approach

This research has taken a novel approach to the task of archaeological landscape analysis, producing and analysing 3D data that represents the site in a very intuitive way. This has attempted to address a call within the field of landscape analysis to reduce the abstractions of data and engage with it in a more natural way, yet to hold the empiricism needed to draw reliable conclusions (Wüst et al. 2004; Frischer and Dakouri-Hild 2008; Hermon 2008; Bourdier et al 2015). In this regard this approach has been a success, creating an accurate digital reconstruction of the site including both human made structures as well as the natural terrain in which they are situated.

Similar approaches have been applied to largely urban environments such as the cities of Pompei (Dell'Unto et al. 2015) and Copan (Richards-Rissetto et al. 2012). These flagship studies have demonstrated the strengths of a 3D approach to understanding large, complex and visually complicated environments. This research contrasts these sites in the relative simplicity of Mount Dutton Bay, offering only a few structures and a bare and open landscape. Such a South Australian colonial setting may appear limited, however this research has shown the strength of a three dimensional approach to engaging with this data. The research of Grguric (2007;2008) serves as highly comparable work done in a more traditional way. As with issues at Mount Dutton Bay, Grguric's small stations sit at an odd scale for landscape analysis. Their context within the larger landscape is highly important to understanding some aspects of the sites, yet the arrangement of

the structures upon the sites are also critically important in understanding the more nuanced aspects of human behaviour enacted there.

Grguric's approach used traditional two dimensional site diagrams to take a top down slice of the site layout. Fortunately for Grguric, in the case of Central Outstation the terrain was very flat and so the visibility was a clear case of line of sight. The same was not true of other sites in Grguric's research however, such as the homestead at Mount Benson. Figures 6.10 and 6.11 show the way that the terrain and structures were recorded in a traditional two dimensional approach. When compared with the three dimensional approach it can be seen that this is quite limited, not only regarding the visual engagement of the data, but also the questions that can be asked of the data. The three dimensional approach, as demonstrated, allows the visibility to be determined automatically and mathematically, for greater surrounding areas and offers the chance to test different conditions, such as changing window heights, to compare ranges of visibility.

The assessments of visibility made during this research also exceeds what is possible with a ground based inspection of the site. Features such as trees, or contemporary residential structures added to the site since the era in question, are easily removed, allowing the visibility analysis to address the landscape in a much closer form to that which would have been present in the 1870s. Similarly, features that were once present and since removed can be speculatively added to the scene. The homestead for example, added to

the scene based on historic photographs showing its original location, provided an opportunity to inspect the visual landscape with the additional presence of this structure.

A further strength of this approach, which is more difficult to quantify, is the telepresence offered by the landscape reconstruction. To engage with the data in three dimensions, in a visually clear manner matching reality, provides a much clearer presentation, comprehension and opportunity for interpretation, hypothesis testing. This also offers new methods of dissemination that two dimension drawings and maps alone can not offer. In this way, the application of three dimensional landscape analysis techniques begins to bridge the gap identified by phenomenologists and other archaeologists, who call for a more experiential engagement with the past before drawing conclusions (Barrett and Ko 2009; Forbes 2007; Tilley 1994).

One final strength relates to the preservation of data. The structures and site have been recorded in their current conditions in a high amount of detail. This data is thus preserved and can be assessed and engaged with at any time, even when the conditions of the site change. This is highly important from a cultural heritage management perspective, as well as for any future research which may want to ask different questions of the site which may no longer be possible based on preservation or access. This data offers the opportunity of interaction via a digital platform anywhere in the world, and experienced in a detail that two-dimensional data does not offer.

6.4 Conclusion

This study goes some way to demonstrate the potential of 3D landscape analysis to address the dichotomy that exists between theoretical approaches based on empirical spatial information and nuanced comprehensions of past human attitudes and relationships towards space. Representing data from Mount Dutton Bay in a three dimensional, scene integrated way, revealed the complexities of maritime culture and the diverse nature of this coastal site.

The approach to this spatial analysis through the archaeological visualisation as part of a 3D landscape analysis, enabled the cognition of various data from several existing and previous sources. This highlighted the relationships between natural site features and built material culture, which when organised in this way can be used to test and form hypotheses.

The research also demonstrated the fit of 3D landscape analysis within traditional archaeological landscape analysis methods. Determining its ability to capture, unify, test, and add to a broad range of landscape and theoretical perspectives. The application of experiential methodologies via the extension of visualisation principles into 3D data, showed the ways that colonial people at Mount Dutton Bay engaged with coastal space by considering the environmental range of vision in relation to local topography.

The engagement of this data in a holistic and visually detailed way, has produced a number of interpretations of the attitudes towards the coastal space which support the views within the literature of a unique coastal landscape, as well as many overlapping landscapes which combine together to create one whole. This data provided both a description of site activities that unify and validate the historical records, as well as providing insights into the attitudes and complex relationship between land and sea within the mind of those colonists who created this site.

The research has identified views towards working and living space that can be extended to include the ocean as a working space even among those whose professions may otherwise have been considered terrestrial in nature. The research has also uncovered a landscape of fear and fortification that may have influenced the mindset of the pastoralists who built the structures and acted within this facility. Uncovering the defensive nature of the buildings at this site demonstrates the longevity of this mindset of fear which persisted from the conflicts of the 1840s and has now been shown to have influenced colonial strategies towards space all the way to the 1870s.

6.5 Future Recommendations

This study has served as a detailed landscape analysis for the site that focuses on the complex and its layout with some description provided to give a larger landscape context. A number of avenues of potential future study can recommended based on this work. The pedestrian surface surveys conducted throughout this research were done to answer highly spatial questions and only recorded the presence and absence of materials with very limited recordings of the attributes of the materials themselves. These surveys reveal an abundance of materials including bottles and industrial equipment. With the inclusion of the private collection of material artefacts that are on display at the site, a detailed artefact analysis could be conducted which may be further descriptive of the activities and attitudes at the site.

A further recommendation for future study would be the collection of oral histories from the area. The descendant community is passionate about their past and may hold many stories and insights into the history of the site that is not available in written or material record. This would be an invaluable perspective in understanding both the activities and attitudes of people who acted at the port and woolshed.

A final recommendation of this research is to apply similar methods of visualisation and virtual archaeology to other multifaceted coastal sites. As demonstrated, for example, by the integration of photogrammetry models viewed in the unified 3D scene, with many sources of data integrated

including satellite imagery, and digital elevation models, this has the potential to test and add alternate hypothesis and views which were otherwise invisible.

REFERENCES

Agisoft

2013 Agisoft PhotoScan User Manual: Professional Edition, Version 1.0.0. Electronic document, http://downloads.agisoft.ru/pdf/photoscan-pro_1_0_0_en.pdf, accessed July 18, 2016.

Anschuetz, Kurt F., Richard H. Wilshusen, and Cherie L. Scheick

2001 An Archaeology of Landscapes: Perspectives and Directions. *Journal of Archaeological Research* 9(2):157–211.

Arun, Pattathal Vijayakumar

2013 A Comparative Analysis of Different DEM Interpolation Methods. *The Egyptian Journal of Remote Sensing and Space Sciences* 16(2):133–139.

Ash, Aidan

2007 The Maritime Cultural Landscape of Port Willunga. In *Flinders University Maritime Archaeology Monographs Series*, No.4. Flinders University, Adelaide.

Ashmore, Wendy., and Arthur B. Knapp (editors)

1999 Archaeological Landscapes: Constructed Conceptualized, Ideational. In *Archaeologies of Landscape: Contemporary Perspectives,* edited by Wendy Ashmore and Arthur B. Knapp, pp. 1–30. Blackwell Publishers, Massachusetts.

Ashmore, Wendy

2004 Social Archaeologies of Landscape. In *A Companion to Social Archaeology*, edited by Lynn Meskell and Robert W. Preucel, pp. 257–271. Blackwell Publishing, Malden.

Baillie, Percy J .

1978 *Port Lincoln And District: A Pictorial History.* Lynton Publications PTY, Blackwood.

Barrett, John C., and Ko Ilhong

2009 A Phenomenology of Landscape: A Crisis in British Landscape Archaeology. *Journal of Social Archaeology* 9(3):275–294.

Bourdier, Camille, Oscar Fuentes, and Geneviève Pinçon

2015 Contribution of 3D Technologies to the Analysis of Form in Late Palaeolithic Rock Carvings: The Case of the Rocaux-Sorciers Rock-Shelter. *Digital Applications in Archaeology and Cultural Heritage* 2(2):140–154.

Burke, Heather, and Claire Smith

2004 *The Archaeologist's Field Handbook*. Allen and Unwin, New South Wales.

Casanova, Jack

1992 *Fading Footprints: Pioneers, Runs & Settlement of the Lower Eyre Peninsula*. Jack Casanova, Port Lincoln.

Ch'ang, Eugene, Robert J. Stone, and Theodoros N. Arvanitis

2004 The Shotton River and Mesolithic Dwellings: Recreating the Past from Geo-Seismic Data Sources. *Proceedings of the 5th International Symposium on Virtual Reality, Archaeology and Cultural Heritage* 125–133.

Cockburn, Rodney

1927 *Pastoral Pioneers of South Australia*, Vol. I. Publishers Limited, Adelaide.

Colvin, Peter

2011 The Historical and Archaeological Investigation of the Oyster Cutter Caprice. Unpublished Master's Thesis, Department of Archaeology, Flinders University of South Australia, Adelaide.

Coxhill, Phyllis, Jon Marshallsay, Jane Simons, Matthew Stuchbery, and Paddy Waterson

2006 Report on the Mount Dutton Bay Station. Electronic document, http://ehlt.flinders.edu.au/archaeology/fumasd/Document/2006%20Mount%20Dutton%20Bay/TEAM%204%20-%20TERRESTRIAL%20TEAM%20-%20Phyllis%20Coxhill,%20Jon%20Mashallsay,%20Jane%20Simons,%20Matthew%20Stuchbery,%20Paddy%20Waterson/Reports/Mount%20Dutton%20Bay%20Station%20Report.pdf, accessed January 20, 2017.

Cumpston, John S.

1986 *Kangaroo Island 1800–1836*. Roebuck, Canberra.

Danvers Architects

1987 *Heritage Survey of the Eyre Peninsula and West Coast: Region 12 – South Australia*. South Australian Department of Environment and Planning, South Australia.

De Reu, Jeroen., Plets Gertjan, Verhoeven Geert, Philippe De Smedt, Bats Machteld, Cherretté Bart, Wouter De Maeyer, Deconynck Jasper, Herremans Davy, Laloo Pieter, Marc Van Meirvenne, and Wim De Clercq

2013 Towards a Three-Dimensional Cost-Effective Registration of the Archaeological Heritage. *Journal of Archaeological Science* 40(2):1108–1121.

Dell'Unto, Nicoló., Giacomo Landeschi, Anne-Marie Leander Touati, Matteo Dellepiane, Marco Callieri, and Daniele Ferdani

2015 Experiencing Ancient Buildings from a 3D GIS Perspective: A Case Drawn from the Swedish Pompeii Project. *Journal of Archaeological Method and Theory* 23(1):73–94.

Dimitriadis, George

2003 *Landscapes in Mind: Dialogue on Space between Anthropology and Archaeology*. Archaeopress, England.

ESRI

2012 The Multipatch Geometry Type. ESRI White Paper December 2008. Electronic document, http://www.esri.com/library/whitepapers/pdfs/multipatch-geometry-type.pdf, accessed August 20, 2016.

Ewens, Leonard J.

1952 *The Little Ships of the Pioneer Years*. Vol. 1. The Pioneers' Association of South Australia, Adelaide.

Fleming, Andrew

2006 Post-processual Landscape Archaeology: A Critique. *Cambridge Archaeological Journal* 16(3):267–280.

Forbes, Hamish

2007 *Meaning and identity in a Greek landscape: an archaeological ethnography*. Cambridge University Press, New York.

Ford, Ben

2011a Coastal Archaeology. In *The Oxford Handbook of Maritime Archaeology,* edited by Ben Ford, Donny L. Hamilton, and Alexis Catsambis, pp. 763–785. Oxford University Press, Oxford.

Ford, Ben

2011b *The Archaeology of Maritime Landscapes.* Springer, New York.

Foster, Robert., and Amanda Nettelbeck

2012 *Out of the Silence: The History and Memory of South Australia's Frontier Wars*. Wakefield Press, Kent Town.

Frischer, Bernard, and Anastasia Dakouri-Hild

2008 *Beyond Illustration: 2D and 3D Digital Technologies as Tools for Discovery in Archaeology*. Archaeopress, England.

Grguric, Nicolas

2007 The Archaeology of Fear in Frontier South Australia and the Northern Territory, ca 1847–1885. Unpublished Honour's Thesis, Department of Archaeology, Flinders University of South Australia, Adelaide.

Grguric, Nicolas

2008 Fortified Homesteads: The Architecture of Fear in Frontier South Australia and the Northern Territory, ca. 1847–1885. *Journal of Conflict Archaeology 4* (1–2):59–85.

Harrison, Robert

1862 Colonial Sketches: Or, Five Years in South Australia, with Hints to Capitalists and Emigrants. Hall, Virtue, and Co., London.

Harrison, Rodney

2004 *Shared Landscapes: Archaeologies of Attachment and the Pastoral Industry in New South Wales*. UNSW Press, Sydney.

Hermon, Sorin

2008 Reasoning in 3D: A Critical Appraisal of the Role of 3D Modelling and Virtual Reconstructions in Archaeology. In *Beyond Illustration: 2D and 3D Digital Technologies as Tools for Discovery in Archaeology*, edited by Bernard Frischer and Anastasia Dakouri-Hild, pp. 35–44. Archaeopress, England.

Hodder, Ian

1977a Some New Directions in the Spatial Analysis of Archaeological Data at the Regional Scale (Macro). In *Spatial Archaeology*, edited by David L. Clarke, pp. 223–342. Academic Press, London.

Hodder, Ian

1977b Spatial Studies in Archaeology. *Progress in Human Geography* 1(1):33–64.

Inter-governmental Committee on Surveying and Mapping

2007 *Standards and Practices for Control Surveys*. Electronic Document, http://www.icsm.gov.au/publications/sp1/sp1v1-7.pdf, accessed November 10, 2016.

Khan, Amer

2006 Pier Reviewed: A Study of Port-Related Structures in South Australia. Unpublished Master's Thesis, Department of Archaeology, Flinders University of South Australia, Adelaide.

Katsianis, Markos, Spyros Tsipidis, Kostas Kotsakis, and Alexandra

Kousoulakou

2007 A 3D Digital Workflow for Archaeological Intra-site Research Using GIS. *Journal of Archaeological Science* 35:655–667.

Kimura, Jun

2006 Interpreting Maritime Cultural Space through the Utilization of GIS: A Case Study of the Spatial Meaning of Shipwrecks in the Coastal Waters of South Australia. Unpublished Master's Thesis, Department of Archaeology, Flinders University of South Australia, Adelaide.

Landeschi, Giacomo., Nicolo Dell'Unto, Karin Lundqvist, Daniele Ferdani, Danilo Marco Campanaro, and Anne-Marie Leander Touati

2016 3D-GIS as a Platform for Visual Analysis: Investigating a Pompeian House. *Journal of Archaeological Science* 65:103–113.

McCarthy, John, and Jonathan Benjamin

2014 Multi-Image Photogrammetry for Underwater Archaeological Site Recording: An Accessible, Diver-Based Approach. *Journal of Maritime Archaeology* 9(1):95–114.

Oliver, Margaret A.

1990 Kriging: A Method of Interpolation for Geographical Information Systems. *International Journal of Geographic Information Systems* 4:313–332.

Pope, Alan

1989 *Resistance and Retaliation: Aboriginal-European Relations in*

Early Colonial South Australia. Heritage Action, Bridgewater.

Puckridge, Freeman

2016 History of the Mount Dutton Bay Wool Shed. Paper presented at the Mount Dutton Bay Woolshed Museum. Eyre Peninsula.

Richards-Rissetto, Heather., Fabio Remondino, Jim Robersson, Jennifer von Schwerin, Giorgio Agugiaro, Gabrio Girardi

2012 Kinect and 3D GIS in Archaeology. *Proceedings of the 18th International Conference on Virtual Systems and Multimedia (VSMM)* 331-337. Milan, Italy.

Shefi, Debra

2006 *The Development of Cutters in Relation to the South Australian Oyster Industry: An Amalgamation of Two Parallel Developing Industries*. Flinders University Maritime Archaeology Monograph Series Number 11. Department of Archaeology, Flinders University, Adelaide.

Shultz, Robert J.

2015 Edward Gibbon Wakefield and the Development of his Theory of “Systematic Colonization.” Unpublished Master’s thesis, University of Omaha, Omaha.

Spencer, Diana

2007 Rome at a Gallop: Livy, on not gazing jumping or toppling into

the void. In *The Sites of Rome. Time, Space, Memory,* edited by David H.J. Larmour and Diana Spencer, pp 61–101. Oxford University Press, Oxford.

Steuer, Jonathan

1992 Defining Virtual Reality: Dimensions Determining Telepresence. *Journal of Communication* 42(4):73–93.

Stewart, David J.

2011 Putting the Wheels on Maritime Cultural Landscape Studies. In *The Archaeology of Maritime Landscapes,* edited by Ben Ford, pp. vii–x. Springer, New York.

The South Australian Government Gazette

1842 [A public announcement describing the occupational leases available] The South Australian Government Gazette, December 22.

The South Australian Government Gazette

1911 [Article announcing the reservation of sections of the hundred of Lake Wangary by the Marine Harbours Board] The South Australian Government Gazette, December 22.

Tilley, Christopher

1994 *A Phenomenology of Landscape: Places, Paths and Monuments.* Berg Publishers, Oxford.

Tilley, Christopher.

2010 *Interpreting Landscapes: Explorations in Landscape Phenomenology*. Left Coast Press, Walnut Creek.

Wallace-Carter, Evelyn

1987 *For They Were Fishers: The History of the Fishing Industry in South Australia*. Amphitrite Publishing House, Adelaide.

Westerdahl, Christer

1992 The Maritime Cultural Landscape. *The International Journal of Nautical Archaeology* 21(1):5 –14.

Westerdahl. Christer

2011 The Maritime Cultural Landscape Revisited. In *The Archaeology of Maritime Landscapes,* edited by Ben Ford, p. 331. Springer, New York.

Wheatley, David, and Mark Gillings

2002 *Spatial Technology and Archaeology: The Archaeological Applications of GIS.* Taylor & Francis, London.

Wittur, Joyce

2013 *Computer-Generated 3D-Visualisations in Archaeology: Between Added Value and Deception*. Archaeopress, England.

Wüst, T., S. Nebiker, R. Landolt.

2004 Applying the 3D GIS DILAS to Archaeology and Cultural Heritage Projects Requirements and First Results. *International Archives of Photogrammetry Remote Sensing and Spatial Information Sciences* 35(5):407–412.