ARCHAEOLOGY PROCEDURES MANUAL

PORT ARTHUR HISTORIC SITE MANAGEMENT AUTHORITY

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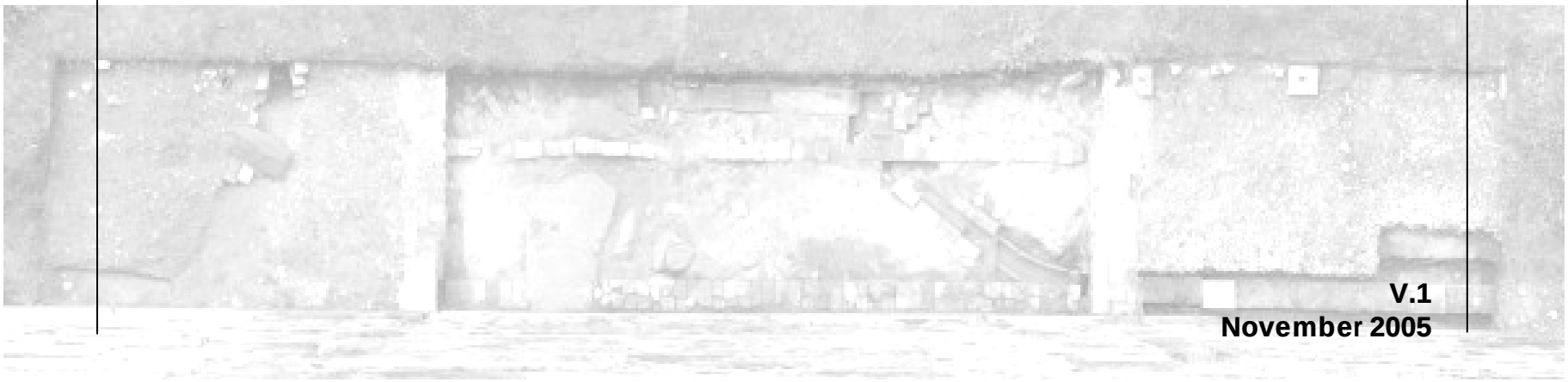

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Port Arthur Historic Site Management Authority
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This manual constitutes Volume 3 of the PAHSMA Archaeology Plan. It is intended for use within the Port Arthur Historic Site. No liability is accepted for any other use of this manual.

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Port Arthur settlement, 1860, PAHSMA.
R. Tuffin, 2004, Penitentiary Ablutions, Trench 1, 2004, PAHSMA.

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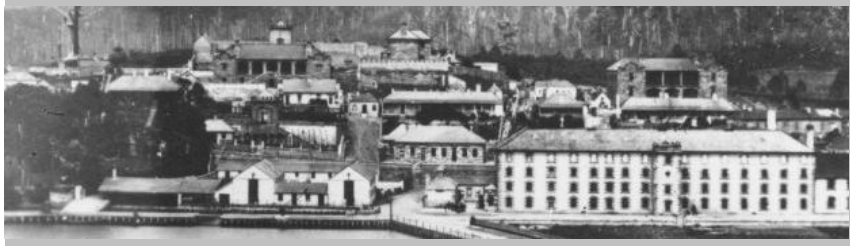
PORT ARTHUR
HISTORIC SITE
1830
THE AUSTRALIAN
CONVICT EXPERIENCE

1 Introduction

In 1987, at the cessation of the Port Arthur and Conservation & Development Project, a seminal document was produced outlining the systems and techniques devised over what had been, up to that point, the most sustained programme of historical archaeological investigations carried out in Australia. The PACDP Archaeological Procedures Manual provoked debate within a field that, up to that time, was characterised by considerable variation in field and laboratory techniques. Its revolutionary combination of extant fabric, structure evolution and excavation recording, collections processing, survey and information management systems positioned the document as a pivotal resource in Australian archaeological methodology, and has continued to shape archaeological practice at the Port Arthur Historic Site through to the present. Since its publication, substantial developments have occurred across the spectrum of archaeological method and theory, and a revised and updated set of methodological principles and procedures are needed to progress archaeology and archaeological resource management at Port Arthur into the new millennium.

The second edition of the Port Arthur Archaeological Procedures Manual was produced for internal use within the Port Arthur Historic Site, however in its adherence to standard archaeological procedures and the Burra Charter process it is hoped that it may find wider application within the discipline. It is not intended to be an entry-level archaeological field handbook. Rather, it is a guide to the systems and practice developed or used at the Port Arthur Historic Site. This naturally prescribes the scope of the manual and shapes its emphasis. Nonetheless it is hoped that it will make a meaningful contribution to the discussion and advancement of historical archaeological practice in Australia, and in so doing prove itself a suitable successor to the original edition.

1. INTRODUCTION



2 Basic principles

2.1 Philosophical approach; best conservation practice

Archaeology at Port Arthur takes its cue from the enabling legislation for the Historic Site, the PAHSMA Act 1987, which states that the Authority shall:

- **7 (2) *(b)* coordinate archaeological activities on the historic site**
- **7 (2) *(c)* promote an understanding of the historical and archaeological importance of the historic site**

The PAHSMA Act 1987 is a powerful piece of archaeological legislation and establishes the Port Arthur Historic Site as Australia's foremost archaeological park. The PAHS *Archaeology Plan* Part 1 (2003) develops a statement of archaeological significance that summarises the reasons for doing archaeology within the reserve and forms the basis for 40 polices for conserving, revealing, realising and managing its archaeological values.

The policies developed within the PAHS *Archaeology Plan* are distilled from a wide range of international, national and State-based standards and approaches, and cover the following areas of archaeological management:

- **Standards and protocols**
- **In-situ preservation and the precautionary principle**
- **Assessment and control of impacts**
- **Research imperative and design**
- **Site Maintenance , Monitoring and Interpretation**
- **Collections and Information Management**
- **Public participation and education**
- **Holistic resource approach - Cultural landscapes**
- **Community involvement**
- **Aboriginal heritage**
- **Alignment of State policy**
- **Alignment of Local policy – Catchment zoning**
- **Reserve zoning**
- **Management orientation and resourcing**

Collectively these policies encompass the processes for conserving significance outlined within the Australia ICOMOS (Burra) Charter.

2. BASIC PRINCIPLES

Port Arthur Statement of Archaeological Significance

- The archaeology of Port Arthur encompasses the structures, deposits, objects and cultural landscapes that hold meaning for modern communities because of their capacity to connect people with Port Arthur's past. Aboriginal, penal and post-convict fabric and associations are melded together at Port Arthur, positioning archaeology as the principal means by which the many stories written into the fabric of the place may be explored, and perspectives shared.

- At the present time, the principal value of archaeology at Port Arthur relates to its research potential to yield insight into the varying experiences, life-ways and operations of the convict system, and the ways in which our own lives are shaped by the legacies of that system.

- The physical resources amenable to archaeological research are unique, finite and non-renewable, and can contribute information not available from other sources. The universe of potential research questions is infinite, and those asked will evolve and change. The Port Arthur archaeological resource is significant because of things we have wanted to know in the past, desire to know now, and may wish to know in the future about Port Arthur and its place in the World.

- Archaeology at Port Arthur is an essential tool for enabling people to experience and participate in the processes of learning about the past.

- Port Arthur is an important place for teaching and learning about archaeology.

At the most basic level, archaeological management at Port Arthur reflects the imperative to conserve cultural significance. In most cases this is interpreted as giving primacy to the convict period.

2.2 Cultural landscape systems: the big picture

For an archaeologist 'context is everything'. Understanding the big picture at Port Arthur is vital to understanding the role of the smallest part. Awareness of the many scales at which Port Arthur operated in the past, culturally, temporally and geographically, enables models to be formulated that can be tested by specific archaeological investigations.

The physical expression of Port Arthur's convict period is spread over a wide geographic area, extending over many times that of the Historic Site Reserve. The archaeological resources potentially available to document the past include all manner of culturally modified fabric, including landforms, buildings, plantings, spaces, cultural deposits, artefacts, collections and records.

Complex 'real world' cultural phenomena require a textured palette of methods and techniques to render as archaeological information. However even the most complicated cultural landscape can be thought of in terms of basic components. Making sense of the big picture demands a systematic approach to collecting and managing data at the smallest scale, and a rigorous and transparent discussion of its research potential and limitations. Data are never created in an intellectual vacuum.

2.3 Small details: the building blocks

Archaeology at Port Arthur is based on the generally accepted principle that archaeological 'facts' are not self evident, but are crafted from a continuum of potential material evidence in response to specific archaeological questions. Filters are applied in all stages of the investigation process, and awareness of the ways in which data are shaped by the investigator has important implications for how cultural phenomena are archaeologically documented and analysed.

At Port Arthur a range of standard forms, recording sheets, and databases are used to ensure that a minimum level of descriptive and contextual information is captured for each discrete archaeological entity. This enables data to be broadly objective and comparable in detail, and suitable as evidence to support a wide range of potential research questions. Central to the effectiveness of this system is the capture of both intrinsic and relative information. Intrinsic information resides in descriptions of the physical characteristics of the entity, whereas relative includes spatial, temporal and stratigraphic information that enables relationships with other entities to be determined. Specific recording methods and forms are discussed under the relevant activity headings within this manual.

2. Basic Principles

Fig.1: Separate Prison Keeper's Quarters (PAHSMA 2002)

3 Conservation Process

Archaeology is the study of material culture. At Port Arthur Archaeology is carried out within the context of understanding and conserving the cultural significance of the Historic Site and its setting. In this sense the PAHSMA practices 'Conservation Archaeology', the aims of which are to inextricably liked to physical conservation, site interpretation, education and tourism management outcomes. Integrating archaeology in Site management involves a layered strategy that reflects the ICOMOS (Burra) Charter process (see Table 1).

3.1 Initial assessments

Otherwise known as desktop studies or archaeological impact statements, initial assessments involve the collation and synthesis of readily available information, including oral, textual and graphic, pertaining to a place or project. As the term implies, initial assessments are not intended to be the definitive work on the subject. Their purpose is to produce a relevant summary of potential archaeological resources and values, as well as to identify potential impacts and opportunities, highlighting whether further and more detailed work is warranted.

Sometimes an initial assessment will suffice to provide the information necessary to answer the archaeological research question, or shapes a policy or design that results in avoidance of impacts or improved conservation. In other cases additional documentary or field investigations, including invasive sampling, may be necessary to clarify issues and move the process forward.

3.1.1 Research design and strategic planning: the search for alternatives

Once the extent and significance of the resource as well as potential impacts and opportunities are broadly understood, policies and design solutions can be formulated to achieve the best research and management outcomes. Specific research questions can be created that acquit the communication objectives developed for the Site, or otherwise provide information essential for Site management. One of the fundamental tenets of the PAHS *Archaeology Plan* Part 1 is that archaeological resources should be preferably managed *in situ*, and that all interventions, whether inspired by research or development, should be minimised and unnecessary impacts avoided. Maximising the use of non-invasive techniques, sensitively designing excavation and sampling programs, and ensuring early archaeological input into the design of developments are important ways to steward and conserve Port Arthur's archaeological values.

3. Conservation Process

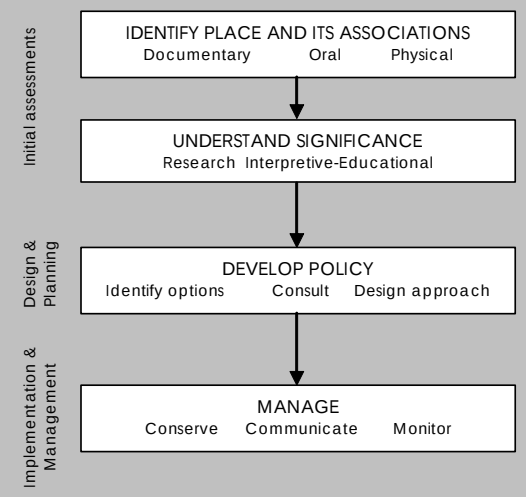


Table 1: Port Arthur archaeological process.

3.1.2 Consultation and approvals

An important part of the policy and solution design process, and worthy of independent mention, is the process of consultation; seeking advice and obtaining the necessary stakeholder input and approvals for works with an invasive archaeological component, or that otherwise have the potential to impact on archaeological values. There are two main groups and processes to consider, covering both internal and external consultation requirements.

Internal consultation
It is a requirement of the *Archaeology Plan* Part 1 that professional archaeological input occurs at an early stage in project planning and design to avoid or minimise adverse impacts on archaeological values and unnecessary delays to projects. For unprogrammed works, sufficient notification and details must be provided to the Site Archaeologist to enable potential impacts to be evaluated and any necessary mitigation designed and implemented.

The notification process and details required are broadly set out in the chart opposite (see Fig. 2). Degrees of significance are defined within the PAHS Conservation Plan.

Procedure	Requirements
1	small impacts on fabric with low significance. Requires notification as soon as practicable prior to works.
2	moderate impacts on fabric with some significance. Requires written notification of works with two weeks notice for preliminary assessment. Sketches/diagrams of proposed works are required.
3	considerable impacts, or affecting fabric of considerable significance. Requires four weeks notice for formal (internal) initial assessment. Requires evidence of compliance with Site conservation policies.
4	substantial impacts and/or projects affecting highly/exceptionally significant fabric. Requires minimum of 3 months notification and detailed description and justification of proposed works for internal and external approval (State and Commonwealth heritage legislation). Requires full conservation study and detailed documentation of proposed works. May require external consultant input.

Where physical impacts and archaeological significance are low only a low level process of consultation is required. Greater impacts and higher degrees of significance trigger more intensive archaeological consultation and input.

Part 2 of the PAHS *Archaeology Plan* (PAHS GIS) enables the generation of maps showing differential significance and sensitivity to impacts which may assist in

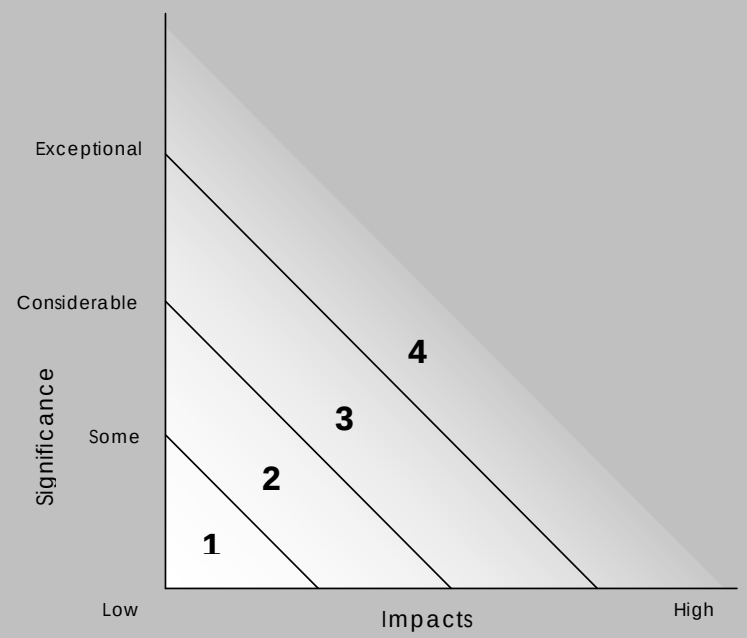


Fig. 2: Internal archaeological notification processes (1-4)

determining the appropriate notification process. Care should be exercised however in interpreting paper-based zoning schemes too prescriptively. The purpose of the internal consultation process is to deliver improved conservation outcomes for the whole Site and not simply prescribe territories of diligence.

External consultation

The PAHS is on the Tasmanian Heritage Register and National Heritage List. Statutory approvals requirements exist in both cases for works which have the potential to impact on the cultural significance of the Site. This includes invasive archaeology and other works in category 4 (above). In most cases it should be demonstrable that the archaeological intervention is part of a larger conservation project, or that the intervention is required to improve understandings of, or enhance the capacity of the Authority to manage, the cultural values of the Site. Consultation with statutory consent authorities and other relevant stakeholder groups, including local government, Parks & Wildlife Service, and other communities of interest at early stages in policy and project design can be critical to ensuring ongoing support for archaeology at Port Arthur (see Fig. 3).

3.2 Implementation and management

The old adage of 'The job isn't finished until the paperwork is done', certainly applies to archaeology. Completion of site reports and acquitting consent conditions are important aspects of modern archaeology, but essential also are the ongoing curating of the site, collections and records, and the communication of archaeological knowledge to the public.

Port Arthur has a long history of archaeological investigation; in many ways the site is a pastiche of interventions and interpretations - a museum of archaeological conservation. Capitalising on the corporate knowledge gained through this process of evolving understanding and maintaining a sustainable approach to current and future archaeology on a Site with a finite *in-situ* resource base is an ongoing challenge.

All manner of conservation approaches can be used to extend the life and viability of archaeological resources. These include preservation, restoration, maintenance, reconstruction and adaptation. Methods may involve the reburial of features, reassembly of collapsed structures, partial reconstruction of missing or depleted entities, installation of structural supports and services around, under and through archaeological sites, chemical and electrical protection of decaying fabric, and use of remote sensing. All these and more have been implemented, evaluated and continue to be developed at Port Arthur.

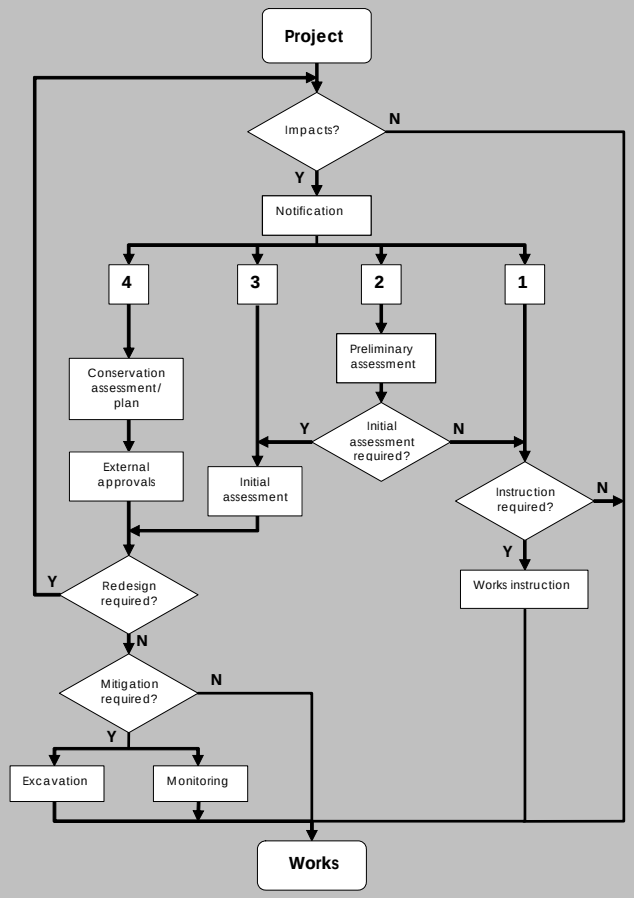


Fig. 3: PAHS archaeology consultation and approvals process

4 Historical Research

At Port Arthur, over two decades of research has amassed an impressive collection of historical resource materials from various institutions throughout Australia. Few researchers have such a focussed resource at their disposal.

Research undertaken at the historic site ranges from small-scale projects; utilising the resources available in the resource centre, to larger projects drawing upon material held outside PAHSMA. Archives, libraries, private institutions and individuals may all hold relevant records. A researcher at Port Arthur may find themselves researching for interpretive signage, a new information booklet, a gift shop product, building conservation project or a journal article. Historical research imbues all aspects of management at the Port Arthur Historic Site.

A well-focussed historical study is fundamental to archaeology at Port Arthur. It enables chronologies of activities to be constructed and provides the historical framework for archaeological questions. Research can find a building lost to the landscape, or repopulate one of the site's ruins. It can provide insights into how people viewed themselves and others: how the diverse classes of free and bond interacted within the confines of the isolated penal settlement. Archaeological excavation does not proceed without first conducting thorough historical research.

The rare exception to the rule is emergency monitoring/mitigation works. The rapid-response nature of these excavations means that substantive research often happens after the fact.

4.1 Guide to sources held at Port Arthur

4.1.1 Maps and plans

The Port Arthur resource centre holds over 2,000 maps and plans: covering historical, archaeological, interpretive, architectural, landscape and management themes. When researching for an archaeological project the first documents referred to are typically historic building plans and maps. A historic map will help locate a structure or feature in relation to others, whilst a map may assist in understanding its layout and use. Sequences of maps and plans help to chart the evolution of a structure or an area. Management maps and plans, including service plans, can be used to indicate potential impacts on archaeological sites, particularly when integrated in a GIS.

Fig. 4: The PAHS Resource Centre is one of the largest repositories of convict historical resources in Australia.

4.1.2 Published secondary sources

The resource centre holds over 1,700 secondary sources in its collection, with topics covering many major facets of research at Port Arthur. The collections are organised according to the *Dewey Decimal Classification* system.

There are 120 sources within the resource centre's reference collection, including published and unpublished materials, and works deemed too valuable to allow open-access.

There are also over 130 journals carried by the library, dealing with a diverse group of topics.

4.1.3 Unpublished secondary sources

These encompass an extensive range of material: completed reports, research data, photographic material and closed files.

The files archive from the PACDP period has been kept intact. Data is catalogued into a number of fields: administration, staff, surveying, buildings, curatorial, interpretation, historical, consultants, summer programs (historical and archaeological), photographic documentation, archaeology. Archaeology (series M2/66/277) covers all research excavations, surveys, mitigation works etc undertaken by the 1980s project.

Early PAHSMA Conservation files are organised according to the system currently in operation.

4.1.4 Photographs

The resource centre holds over 16,000 slides and 6,000 prints. These are organised into three areas: historic, PACDP (1981 - 1987) and PAHSMA (1987 – ongoing).

4.1.5 Reports and Research

Over 600 reports are also available. These are catalogued by building or subject and encompass historical research, archaeological investigations, architect reports, engineering surveys, tour evaluations, management plans (secondary and tertiary) etc.

A large number of supplementary 'research files' are also available. These are arranged alphabetically according to author or subject.

4.1.6 Databases and Indexes

Fig. 5: Port Arthur's impressive visual archive is a vital resource for historical research.

A database of convicts with links to Port Arthur and the Tasman Peninsula is being compiled using the convict Indents, Description Lists and Conduct Registers from the Archives Office of Tasmania. This database can be accessed for information on specific convicts the researcher may encounter in their study.

The 24 volume *Brand Papers*, compiled in 1983, are a part-indexed collation of thousands of transcribed primary documents extracted from the Archives Office of Tasmania and other institutions relating specifically to Port Arthur's convict administration.

In the same vein are the *Glover Papers*, compiled between 1977 and 1979. These comprise three volumes of transcribed primary documentation (much of which is repeated in the *Brand Papers*), organised by building and general subjects.

The resource centre also holds several un-typed research volumes relating to Tasman Peninsula convict sites.

4.1.7 Other Sources

The Archives Office of Tasmania and the Mitchell and Dixon collections (part of the NSW state library), hold many records relevant to Port Arthur. Catalogues for these collections are available online. While copies of many records are held at Port Arthur, the catalogues of external archives should be checked at an early stage in historical research to identify knowledge gaps.

As well as holding extensive secondary source material, the Tasmanian State Library also has a microfilm archive of newspapers. The Tasmaniana library, attached to the State Library, has a similarly extensive collection of secondary sources relating to convict themes, as well as a catalogue of ephemera.

The Internet is also a potentially useful information resource. The online catalogues, publications and grey research reports of many relevant institutions may be found, as can information posted by interest groups and individuals. As with all sources, it is important to cross-check web-based information.

4.2 Using sources

When beginning research it is important to remember that sources are universally subjective. Diary entries, letters, published reminiscences etc present perspectives of the past. Illustrators will take licence; embellishing and toning down features as they see fit. Even the recorders of plans can leave off details such as outbuildings, plantings and pathways that they deem insignificant. It is often these missing details that are of interest to historians and archaeologists.

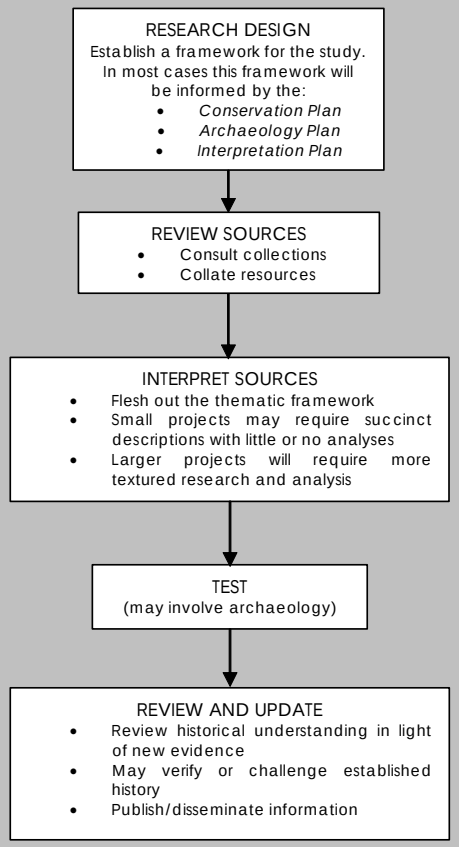


Table 2: Guidelines for Historical Research

Historical research at Port Arthur is usually undertaken as a component of a larger project derived from the *Conservation Plan* and its subsidiaries; the *Interpretation Plan* (see *Interpretation Plan*, 'Themes and Topics' Chapter 3) and *Archaeology Plan* (see *Archaeology Plan*, Sections 5.1.1 and 9.1.2). As such the research is often focussed on answering pragmatic questions which are developed in consultation with the people involved in the project: the historians, archaeologists, interpreters, architects and grounds and works managers (see Table 2).

4.3 Referencing

Port Arthur uses the *Style Manual for Authors, Editors and Printers* (6th edition). Footnotes are used in preference to the Harvard method of referencing.

When referencing within the text:

To cite references:

Books	**First reference:** R Tuffin, G Jackman & J Clark (eds), *A Harbour Large Enough to Admit a Whole Fleet*, PAHSMA, Hobart, 2004, p. 66. **Subsequent references:** Tuffin, Jackman & Clark, p. 70.
Journals	**First reference:** M Nash, 'Convict Shipbuilding in Tasmania', *Tasmanian Historical Research Association*, papers and proceedings, v50, no 2, June 2003, pp. 93, 94. **Subsequent references:** Nash, *Tasmanian Historical Research Association*, p. 92.

Books	Tuffin, R, Jackman G, & Clark, J (eds), 2004, *A Harbour Large Enough to Admit a Whole Fleet*, PAHSMA, Hobart.
Journals	Nash, M, June 2003, Convict Shipbuilding in Tasmania', *Tasmanian Historical Research Association*, papers and proceedings, v 50, no 2, pp. 83 - 106.

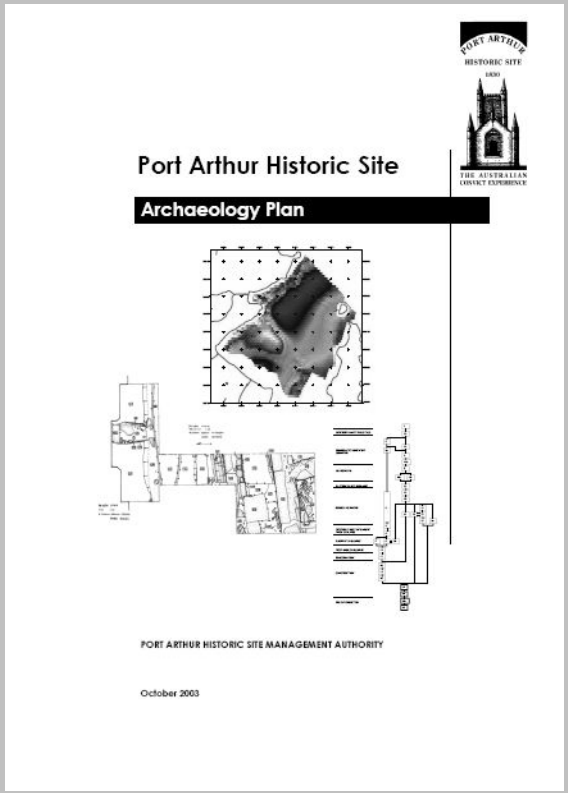


Fig.6: Historical research will often be guided by the existing Archaeology, Interpretation, Landscape and Conservation plans.

5 Non Invasive Investigations

5.1 Aerial imaging

The interpretation of aerial photographs is a routine aspect of field archaeology worldwide. There are two main photographic perspectives; oblique and vertical. Oblique photography has the optical axis at other than 90° to the horizon. A common application of oblique air photography in archaeology is to highlight surface textures, particularly when taken with a low sun angle. Vertical photography, as the name suggests, has the optical axis perpendicular to the horizon. Vertical photography is better suited to measurement and mapping tasks. Vertical air photographs are available for many of Australia's population centres from the 1940s onwards, with the earliest run covering Port Arthur taken in 1946. Subsequent photography taken from the 1960s-present constitutes an invaluable archive documenting land-use and environmental change during the post war period. Given the relative isolation of the Tasman Peninsula and the persistence of convict period landscape patterning well into the 20th century, air photos also provide valuable insights into earlier land-use and cultural practices.

Vertical air photos are usually studied as partially overlapping pairs, which allow stereomodels to be generated and features measured using simple mathematical techniques. Scale and other image distortions in aerial photos can be removed in a process called orthorectification. The resulting orthophotos are planimetrically correct image maps which combine the geometric precision of traditional vector maps with the reflectance information of a raster image. They are a valuable visualisation tool and are increasingly becoming a standard feature of cultural heritage management geographic information systems (GIS). Digital visible colour orthophotomaps are incorporated within the PAHS GIS. The use of single aerial photographs for mapping should generally be avoided (See Fig. 7).

In addition to film-based visible light and near infra-red imagery, improvements in scanning and satellite technology have considerably expanded the range of electromagnetic data available to archaeologists, opening up new avenues for environmental enquiry. Techniques such as multispectral, thermal and hyperspectral sensing enable cultural landscapes to be explored in increasingly sophisticated ways, enriching our understanding of the interactions between people and landscape through time. While these methods are yet to be applied to Port Arthur it is envisaged that they will become part of the standard toolkit for archaeological research and resource management within the next few years.

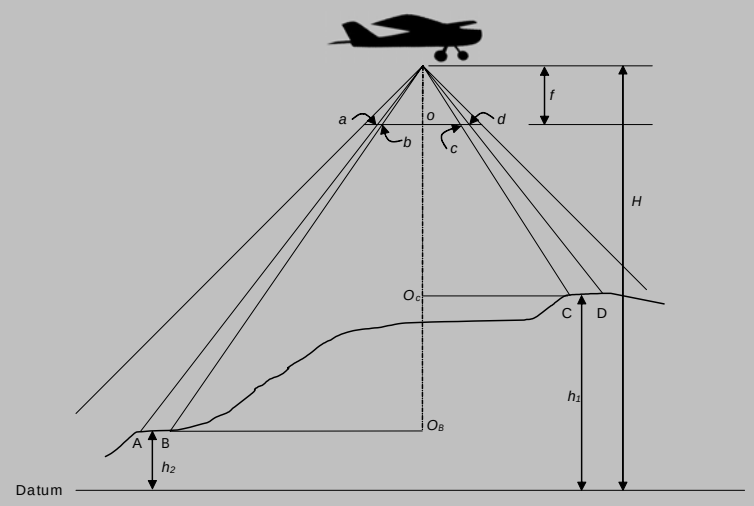


Fig. 7: Air photo interpretation. Note that although the ground distances AB and CD are equal, the distances *ab* and *cd* in the image are not, reflecting the effect of terrain elevation on photo scale

The scale of an aerial photograph is the ratio of a distance on the image to the corresponding distance on the ground. It must be remembered that, unlike a map where the scale is constant in all directions, an aerial photograph is a perspective projection and the scale will vary with terrain elevation. The relationship between scale and object distance is give by the relation $S = f/H^1$ where f is the focal length of the lens and H^1 is the flying height above the terrain at that point (*H - h)*.

5.2 Geophysical remote sensing (Fiona Links)

Terrestrial geophysics is the study of the earth by measuring its physical properties at the surface. Surface geophysical methods can aid archaeology by delineating cultural modifications including buried walls, graves, ditches, paths and landfill. Geophysics is often used to identify target areas for further detailed investigation, including excavation.

Geophysical remote sensing was first applied at Port Arthur in 1986, and since 2002 geophysics has been employed as a routine pre-cursor to controlled excavation and an aid to survey. Methods used at Port Arthur include DC resistivity, electromagnetics, magnetometry, ground penetrating radar and seismic refraction (see Table 3).

Other techniques, including microgravity, and fluxgate gradiometry have not been used at Port Arthur, but may be appropriate for certain projects.

Overall, geophysical techniques are used at Port Arthur for two main reasons;

a) to carry out broad scale survey to locate targets for detailed study, and;

b) for detailed intra-site investigation.

In addition to providing data for preliminary site interpretation, the results of geophysical remote sensing must always be reviewed in the light of other evidence, including archaeological evidence (a process called 'ground-truthing').

When designing a geophysics program it is important to remember that each technique has its own specific area of application and attendant strengths and weaknesses. In general, no one technique should be used in isolation as a basis for site interpretation and decision making. Geophysics should always be conducted by an experienced geophysicist skilled in archaeological interpretation.

5.3 Computer modelling

The increasing availability of desktop computers and software has brought a large palette of sophisticated illustrative, modelling and visualisation tools into the hands or the archaeologist, and signalled the demise of many traditional methods of representing archaeological phenomena. The days of manual drafting machines and laborious hand rendering of measured drawings are over for all but the most specialised of tasks. In general, computer aided drafting (CAD), 3D modelling and photo rendering have made precise, repeatable depiction of archaeological sites and objects a matter of routine. Such representations may lack the artistic merit and interpretive clarity of traditional vector illustrations, but they bring many benefits, including spatial and

- DC (direct current) resistivity methods utilise a direct injection of electrical current into the ground in order to measure the resistance to current flow between two probes, which is expressed in terms off a resistivity in ohms per metre. A more sophisticated multi-probe technique, known as electrical imaging, is useful for producing vertical sections of electrical resistance. Numerous factors can influence ground resistance, including native conductivity, soil structure, water content and pore connectivity.

- Electromagnetics, another active method, involves generating a time or frequency-varying magnetic field at the surface, which induces a similarly varying electrical current response in the substrate. A receiver compares the ground magnetic field response to that generated at the source. EM responds to the electrical conductivity of materials and is effective for shallow subsurface mapping of clays and ground salinity, and also for locating metallic objects. Results are expressed as a conductivity value, measured in milliSiemens per meter.

- Magnetic methods passively measure the Earth's total magnetic field strength (in nanoteslas) at any given location. Local variations in the Earth's magnetic field result from contrasting levels of magnetic susceptibility, reflecting differences in ground composition, disturbance and the effects of heating – or thermoremanent magnetism.

- Ground penetrating radar (GPR) involves transmitting pulses of ultra high frequency radio waves into the ground from an antenna moving along the surface. The transmitted energy reflects off distinct material boundaries, such as buried objects, and is recorded by a receiver. Continuous data collection builds a profile of subsurface electrical conductivity contrasts. GPR allows for estimation of target depths, and horizontal stacking of profiles generates a 3D image of the subsurface. High frequency GPR (250-800 MHz) is useful for near surface archaeological applications (0-10 m) for its high resolution mapping of buried structures and major stratigraphic variations.

- Seismic refraction. A seismic (shock) wave traveling from its source to refracting layers, along those layers and back to detectors (called geophones), is precisely measured, enabling subsurface layer velocities and thicknesses to be calculated. Seismic refection is useful for mapping landfill, water table and bedrock depths.

chromatic precision, and they retain a lot of information often filtered out by more subjective methods.

Coupled with advanced data capture techniques, such as digital photography, photogrammetry and laser scanning, the computer is an invaluable aid for analysing, modelling, visualising and testing archaeological possibilities.

Port Arthur utilises a combination of desktop GIS and CAD to represent, model and analyse archaeological phenomena (see Fig. 8). In general, CAD is suited to design work and tasks that use plane measurements, while the GIS is appropriate for spatial analytical work and tasks that use scaled measurements. This means that things that are intended to be visualised independently or at a large scale and are measured in simple plane distances, such as measured field drawings, computer reconstructions and archaeological works specifications are suitable for CAD. Things that are best modelled at a small scale or are measured and analysed with reference to a cultural landscape or environmental model are best done in a GIS. For instance the features within an individual archaeological trench may be effectively modelled using CAD, whereas a map showing excavation sites and inter-relationships within a landscape is more effectively done with GIS (see 7 'Site Survey').

Occasionally it is found necessary or desirable to move data between platforms, such as when using GIS terrain data to generate archaeological or engineering long sections. Care should be exercised to ensure that the correct scale factor, datum and other relevant transformation parameters are applied in order to retain accuracy and orientation when transferring spatial data between systems. At a practical level the difference between plane and scaled distances is small, at Port Arthur the point scale factor is 0.99965, equating to a difference of 0.35mm/m. This means that a 1m measurement taken on the ground in the horizontal plane will equate to a measurement of 1m in a CAD environment, but only measure 999.65mm in the PAHS GIS.

5.4 Geographic Information Systems (GIS)

There are generally considered to be four main application areas for spatial information technologies in archaeology.

- Description and recording *(Data capture - Instrumentation)*
- Research *(Analysis and modelling – Stats/GIS)*
- Management (DBM/CRM) *(Information and Sites – DBMS/GIS)*
- Method and theory development *(All f the above)*

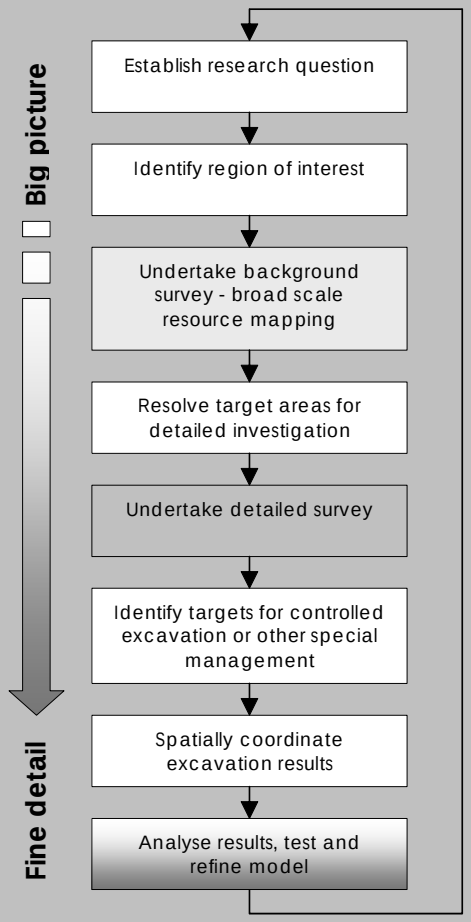


Table 3: The role of geophysical survey at Port Arthur

The use of GIS for representing and modelling archaeological phenomena for research and interpretation has been briefly discussed in the preceding section. Under the management heading the application of GIS can be divided into two principal categories: information/database management (DBM), and cultural resource/fabric management (CRM). The first category involves the maintenance and integration of archaeological databases. At Port Arthur spatial and textual information is coordinated through the Project File Management System which can be accessed through the PAHS GIS.

The second category of GIS application is concerned with the active management and conservation of *in-situ* resources, and largely focuses on resource identification, predictive modelling, and planning. In practice, the CRM use of GIS is an applied extension of the analytical and pattern modelling approaches originally developed to service research objectives, but tailored to achieve conservation planning and implementation outcomes (see Fig. 9).

The PAHS GIS incorporates historic maps and plans, past and current management information and archaeological data sufficient to generate models that represent the extent of known historical activities, highlight archaeological potential, and permit the design and testing of conservation solutions. The system enables spatially related data to be interrogated and analysed, yielding timely information about potential conflicts between operational and conservation objectives. All archaeological and management data is gathered and developed in electronic form to facilitate spatial querying and maintain integrity and currency, although hard-copy maps and reports may be produced for specific purposes. In general, however soft-copy products will continue to be the principal media for representing archaeological resources, modelling past activity and predicting impacts within the reserve.

Termed the Port Arthur Archaeological Resource Management System (see: *Archaeology Plan* Part 2), the PAHS GIS is an interactive data modelling and impact evaluation tool. It is an aid to management decision making rather than a static prescriptive zoning plan.

Fundamental to the effectiveness of the system is the integration of both current and historical management data. All modern site surveys, excavation plans, and rectified imagery are incorporated into the GIS and kept current, as are historical maps and plans.

At any given time, Port Arthur's historical space was highly differentiated with many layers of activity and meaning. By freeing the map from the bounds of its traditional paper form its information can be placed within a realistic environmental setting, enhancing its potential to support such things as viewshed analyses and settlement evolution studies.

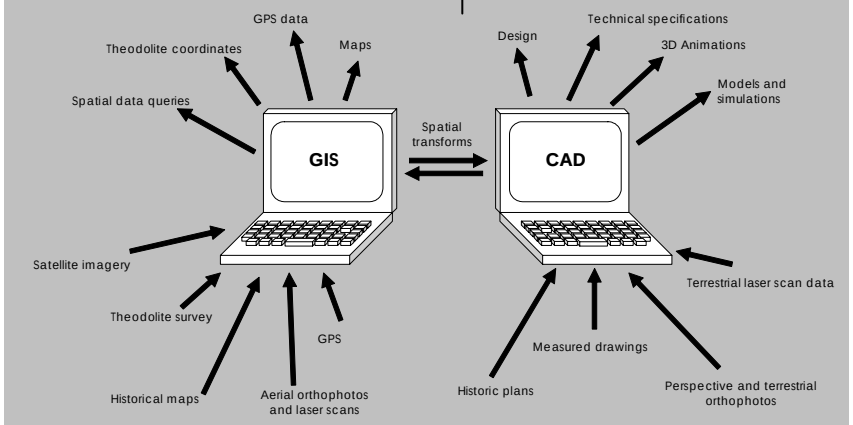


Figure 8: Different computer platforms have different primary applications in archaeology

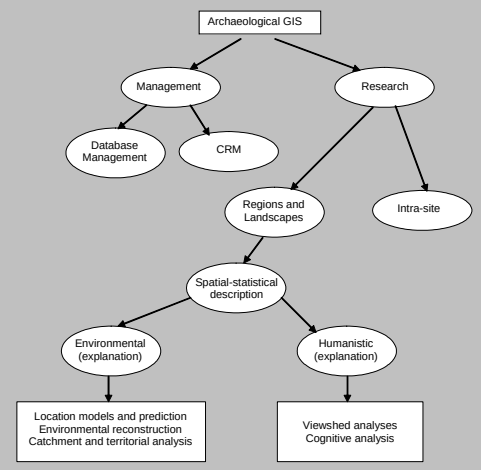


Fig. 9: Current application of GIS in archaeology (Wheatley & Gillings 2002P:234)

A high level of positional certainty for historically documented features is critical for minimising impacts when planning new developments, such as underground service upgrades. It also has positive implications for archaeological analysis and research, particularly in developing and testing models of past understanding and behaviour.

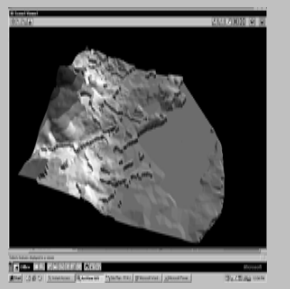
Matthew Gunn, ©PAHSMA 2005

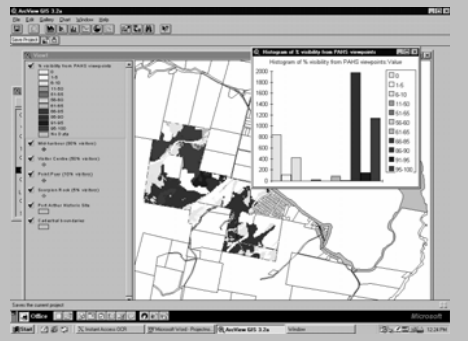
CAD packages are suitable for 2D measured scale drawings and design work, making it the preferred system for preparing works specifications.

CAD systems are also an ideal platform for creating localised detailed 3D models which can aid architectural and archaeological reconstructions, as well as providing textured visuals for site interpretation (top right).

Both CAD and GIS commonly make use of terrain models (centre) which enable design or querying within an appropriate environmental setting.

GIS (bottom right) are best suited to coordinating and querying spatial data over a wide area, often requiring large models that extend well beyond the immediate study area, as in the case of viewshed, catchment or impact analyses (See Section 5.4).





FORT ARTHUR HISTORIC SITE 1830 THE AUSTRALIAN CONVICT EXPERIENCE

5. Non Invasive Investigations

Incorporating historical map information into a GIS is often not a straightforward exercise, as owing to the method of measurement originally used such documents often have significant spatial errors. In the case of Port Arthur, the errors on the critical evolutionary site maps are rarely systematic, with potentially higher accuracy existing in areas of close offset detail than in other areas. As a result a process of piecewise triangulation (rubber sheeting) has been used to create a number of spatially modified historical base maps. The 'corrected' maps have been tested against more recent geophysical survey and excavation data, which found that the rubber sheeting process significantly improved the overall positional correlation between historically plotted and actual locations.

Ultimately the rubber sheeting process is designed to be iterative, with archaeological evidence used to create new spatial links for the next generation of base map. In this way the historical map becomes an evolving document, and is updated like a modern survey. While it can be argued that such a process impacts the historical integrity of the map, the purpose of this exercise is to use the map information as an aid to current management.

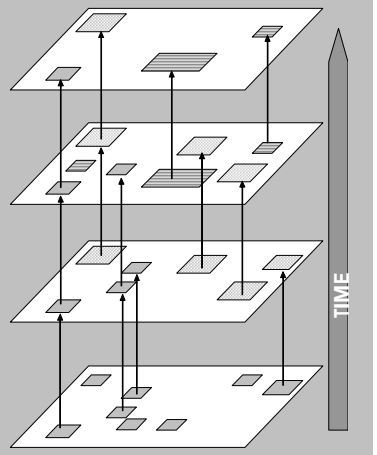


Fig. 10: Building up a modern base plan of historical structures, using the later maps as a key to earlier structures.

6 Health, safety and ethics

6.1 Duty of care

Effective archaeological resource and project management means looking after the welfare of yourself and others, and respecting other peoples' cultural heritage property, and knowledge. A full risk assessment and safety audit should therefore be undertaken before embarking on any project that may carry an element of risk of physical harm, whether it is to ones-self, to a team member or to a member of the public, or damage to a site or property. PAHSMA has a standard risk assessment procedure for archaeological projects that contain a fieldwork element. This covers such things as identifying environmental hazards, necessary equipment, training and certification standards, as well as any required consultation, permissions or approvals. It is an important process for even the most seemingly innocuous project. The simplest of excavations may end up using scaffolding for elevated photography, involve working in confined spaces such as wells and basements, or require contact with landowners, community representatives or members of the public.

Many of the basic requirements of the archaeological project risk assessment and associated implementation plan (risk management plan) are underpinned by legislation; in Tasmania the *Workplace Health and Safety Act* 1995 and associated *Regulations 1998* .Commonwealth legislation also applies in relation to human rights and anti-discrimination. This is important for public agencies such as the PAHSMA which apply a merit based selection process to its volunteer fieldwork programs and promote inclusive public involvement in archaeology.

The purpose of the archaeological risk management plan is to minimise the likelihood of unwanted effects, such as accidents, resulting from archaeological work. Where an accident or damage does occur, the plan ensures that the project has the relevant expertise, resources and systems in place to respond quickly and appropriately in the short term, as well as carrying the necessary long term insurance and work cover protection.

6.2 Professional ethics

In addition to its statutory duty of care to individuals and respect for real property, archaeology must be carried out as, and seen to be, an ethical activity. The *Archaeology Plan* emphasises the importance of working with all stakeholders in understanding and managing the cultural heritage of the Tasman Peninsula and of undertaking archaeological projects both on and off reserve within a consultative and inclusive framework. It should always be borne in mind that the PAHSMA manages land and archaeological resources on behalf of the wider community.

Fig. 11: Workplace safety is a paramount consideration when doing archaeolo0gical fieldwork. Specialists must be used in the appropriate situations. (PAHMSA 2003)

It is essential therefore to ensure that the relevant stakeholder groups are kept informed and involved as much as is possible in any projects that involve their heritage, or have the potential to impact on cultural and economic opportunities.

For instance, entering private property and recording a site for the purposes of nominating it to a local or State heritage register without consulting with landowners is unethical behaviour, irrespective of the merits of academic archaeological argument.

In addition to direct involvement of relevant groups in specific projects, PAHSMA undertakes to include the wider community in the archaeological process through a variety of means. Chief among these are the annual public archaeology and summer volunteer programs. Where possible, PAHSMA also publishes the results of archaeological projects in a range of formats. This includes academic journals, popular magazines, technical papers and via the PAHSMA website (see 16 'Interpretation and Communication').

The Port Arthur Historic Site is a corporate member of Australia ICOMOS and abides by the ICOMOS Australia code of ethics of coexistence in conserving significant places.

Although it is not associated with professional archaeological groups, the codes of ethics of the Australian Archaeological Association and Australian Association of Consulting Archaeologists Inc. are also considered minimum guides for ethical archaeology at Port Arthur.

Professional ethics is not limited to community consultation and involvement, but includes all aspects of project planning, execution, documentation, storage of materials and records, and site conservation and interpretation; in short all of the issues touched upon in this manual.

6. Health, Safety and Ethics

Fig. 12: It is essential to keep all relevant stakeholder groups informed about projects that may impact upon our shared heritage.

7 Site survey

7.1 Finding sites

Archaeological sites are the physical evidence of past human activity in the landscape. They do not record the total relationship or understanding that people have had with the land or each other, but are the residue of certain activities in certain places. Areas where no physical evidence of activity exists may also be places that were used or otherwise culturally meaningful in the past. For example areas between historical building sites that contain no evident structures or identifiable cultural deposits may tell us a great deal about the different ways that intervening spaces were understood and used within a specific cultural and social framework. This has important implications in a penal station context where access to resources, activities and spaces for different classes was highly regulated.

Notwithstanding, much of the visible archaeological resource within the PAHS is relatively easy to find and well documented. Periodically however surveys are carried out in areas of the reserve with a less intensive management history, or in unsurveyed areas within the locality. The traditional approach for locating archaeological sites on the ground is the transect survey. This comprises a usually straight line walked between waypoints whose positions are fixed through some formal survey method, such as traverse or GPS (see below). The transect procedure may involve a team, with members walking at fixed spacings either side of the transect meridian. The spacing of transect lines is dependant on such things as the type and size of the site being sought, and ground visibility; for example a forest survey for sawpits, roads and tramways will have larger transect spacings than a burnt area survey for Aboriginal sites.

A range of different sampling strategies may be adopted for placing transects in the landscape, ranging from fully random to fully selective with various permutations between the two. In practice the strategy adopted will depend on a range of practical variables, such as knowledge of the survey area, site type, land access, ground visibility and available time and resources. At Port Arthur it has been found practicable in most cases to use either systematic or stratified random approaches to sampling. Irrespective of which method is chosen, it is important to understand the potential effect this will have on the likelihood of site identification and the statistical validity of survey results.

7.2 Recording site characteristics

Port Arthur uses standard Tasmanian Historic Places Inventory (THPI) forms for recording individual site details. Completed forms are stored in the relevant project file for the survey. Copies for the completed forms are forwarded to the Historic Heritage Section of the Parks & Wildlife Service.

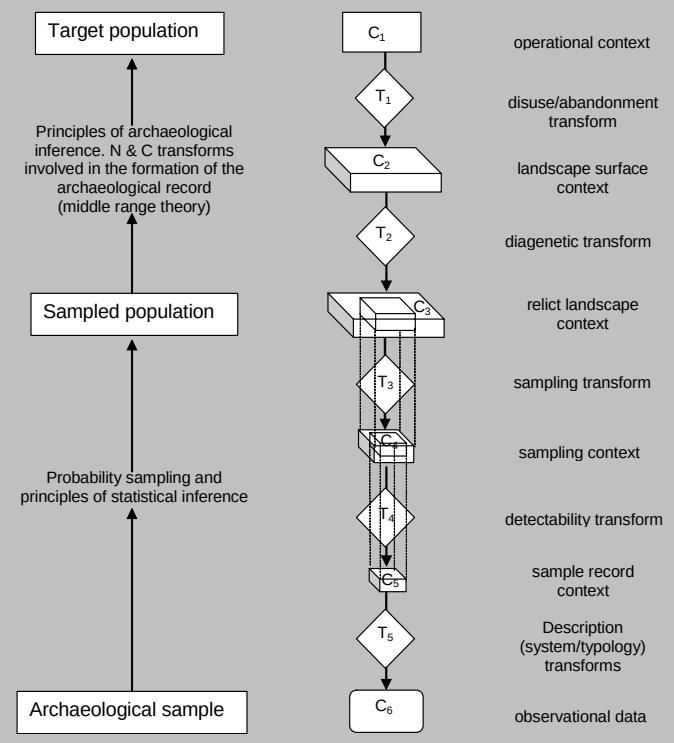


Figure 13: The relationship between observation and target as mediated through the sampling process. (Modified from Orton 2000 p. 42)

In addition to the formal site record or data sheet, it is also important to record details of the survey itself, generally in a project notebook. Anything that might have had an effect on the survey should be noted, such as methodology, definitions, environment type, ground visibility, disturbance and integrity, access issues, survey problems and modifications, mudmaps, detail sketches, and thoughts or interpretations on what the sites might mean individually and how they might fit into a bigger picture. The note-book is the key that you and others will later rely on to understand the survey methodology and the many filters that have been applied in collecting the field data.

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7.3 Positioning and plotting

There are a number of standard methods suitable for archaeological field surveying, and many guides on the subject. It is not the intention of this manual to detail the various procedures here; rather this section will outline the way that standard survey methods are applied at Port Arthur.

Many traditional archaeological survey methods have become redundant due the widespread accessibility of total station and GPS tools. Very few archaeologists would give serious consideration to using plane tables or pace and compass as stand alone methods. At Port Arthur pace and compass is occasionally used in conjunction with GPS in forested traverse situations, however for surveying based on angle and distance measurement the basic method employed is the tape and compass or chain traverse.

The basic principle for all kinds of field surveying, including the traverse, is to work from the whole to the part. This establishes the spatial framework to which detail can be added. A traverse commences at a known (coordinated) station and, using a tape and compass, a magnetic bearing and distance is established to a second station. The reverse bearing is checked at the second station before establishing a third forward station by compass bearing and taped distance. The procedure is continued until the traverse can be closed off on the starting point, or another coordinated point. The angles and distances are then calculated to identify the misclose (the difference between the actual and plotted final positions) and an adjustment of each of the plotted positions of the traverse stations carried out.

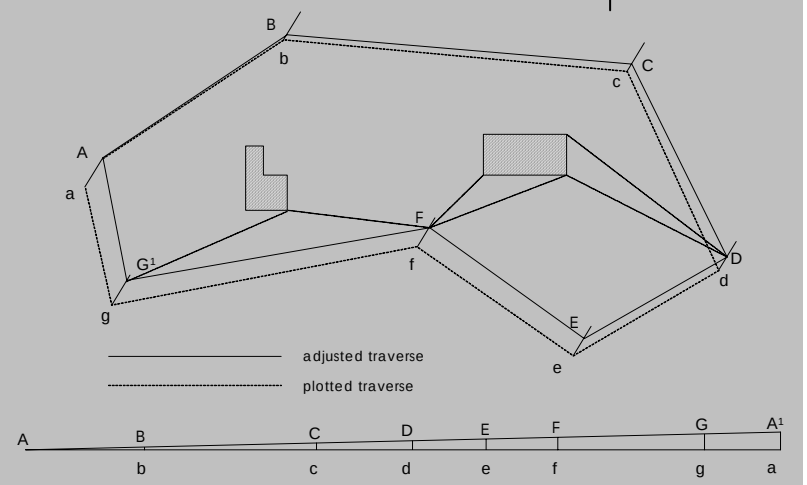


Fig. 14: Bowditch adjustment used for tape and compass traverses

ID	Easting	Northing	AHD	ID	Easting	Northing	AHD
135/3	569109.481	5222313.389	18.948	10753	568890.828	5222549.889	7.628
135/4	570792.705	5220873.368	31.360	10754	568970.158	5222688.334	14.229
7010	569153.177	5222584.19	2.665	10755	568968.586	5222927.488	43.363
8630	568861.946	5222734.736	41.135	10756	569264.31	5222700.803	26.069
8934	568262.323	5222973.415	46.859	10757	569547.078	5222668.801	5.960
8941	569136.486	5222210.052	32.193	10758	569181.385	5222452.78	1.255
9790	570512.74	5222194.589	0.784	10759	569024.655	5222468.085	2.414
9791	569210.322	5222602.086	6.647	10773	569151.9	5222359.634	7.060
9793	569354.69	5222484.754	1.987	10774	569281.464	5222281.755	13.345
10702	567415.77	5223249.204	99.392	10775	569023.147	5222283.961	13.929
10703	567475.567	5223116.238	118.762	10776	569895.76	5224016.413	32.063
10704	567717.415	5222904.833	88.554	10777	569536.27	5221110.972	0.935
10705	568789.579	5222016.593	17.079	10799	570520.471	5221642.716	9.437
10706	568844.705	5222292.624	14.440	9789	570545.1195	5222315.496	1.361
10707	569114.637	5222277.33	27.343	8627	570504.5441	5222226.505	4.540
10752	568848.537	5222457.418	5.720				

Table 4: PAHS Survey control network

It is important to reduce all measured ground distances to horizontal plane or scaled distances before attempting to calculate the misclose or carry out any subsequent detail surveying. For this reason clinometer readings should be taken of all tape measured segments on anything less than flat ground.

A range of methods can be used to adjust traverse miscloses. For a tape and compass traverse the compass (or Bowditch) adjustment is adequate (see Fig. 14). More advanced methods, such as least squares, are appropriate to high precision total station surveying. Detail subsequently collected by radiation or triangulation from station points is plotted in relation to the adjusted traverse.

A traverse that does not close on a known point is called an open traverse, and cannot be adjusted. Open traversing is not recommended.

For general mapping tasks at Port Arthur, all theodolite, GPS, geophysical surveys and aerial orthophotos are referenced to the Australian Geodetic Datum 1994 (GDA94 Zone 55G). The PAHS maintains an intensified 3rd order survey control network which is part of the Tasmanian Survey Control Grid (see Table 4). Scaled measurement is the default mode, enabling seamless integration of survey and excavation data within the PAHS GIS. This also allows excavation targets identified through GIS analysis to be easily uploaded into the instrument for setting out on the ground.

Where surveying is undertaken for engineering or construction purposes, measurements should be converted back to plane distances.

7.4 Levelling

Archaeological features exist in three dimensions, so in addition to the horizontal plane information typically depicted in site surveys it is also often necessary to gather relative height data. While total station surveys also capture height information, in many cases simple and more accurate results can be obtained by using a level (see Fig. 15 & Table 4). The principle of levelling involves establishing an imaginary horizontal plane (line of collimation) above the features whose heights are to be determined. This height of this line must be established by taking a backsight to a point referenced to a standard height datum; in the case of Port Arthur the Australian Height Datum (AHD) Tasmania).

Relative heights of selected field points are measured using a graduated staff read at the intersection point of the line of collimation; i.e. at the cross hairs of the level telescope. The staff readings are either subtracted from the backsight reading (rise and fall method) or subtracted from the collimation height (height of collimation method) to produce reduced levels (relative to AHD) at each point.

The booking detail and cross checks vary for each method. At Port Arthur the height of collimation method is generally used in preference to rise and fall.

Spatial positioning technologies

Total Station/theodolite
Total station surveying is based on the traverse principle, using a highly accurate electronic theodolite linked to a laser EDM (electronic distance measuring) unit. Most modern total station and computer survey packages have traverse adjustment functions.

Once considered a specialist instrument, the total station is now a basic piece of archaeological survey and measuring equipment that will almost certainly be found on any excavation site. Total station surveying may be referenced to either a local or State-based grid measuring in either scale or scaled distance units.

Global positioning system
GPS is a satellite navigation system controlled by the US Department of Defence. A constellation of orbiting satellites provides specially coded signals that are processed in a GPS receiver on the ground, enabling it to compute position, velocity and time. A minimum of four GPS satellite signals are used to establish a position on the earth's surface in three dimensions as well as the time offset in the receiver.

The increased availability of low-cost hand-held GPS units and increasingly acceptable accuracy (+/- 10m) has made them an indispensable tool for archaeological survey and navigation. It is important to take advantage of optimal satellite geometry, which may have implications for fieldwork schedules. GPS predictive satellite coverage should be checked before commencing fieldwork. Where it is possible to re-visit the site, it may be useful to obtain a rough fix with a hand-held unit on the first pass and then revisit the site during an optimal period with a higher precision unit. For such work dual frequency beacon receivers and highly precise Real Time Kinetic systems are available. These are unlikely to be cost effective for reconnaissance or first pass surveys.

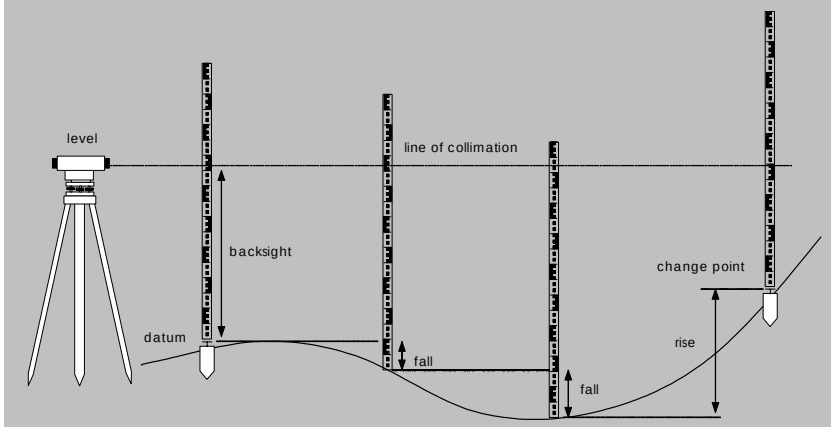


Fig. 15: Whether using the line of collimation method, or by rise and fall, the information must be referenced to a known height datum.

Backsight	Intersight	Foresight	Height of collimation	Reduced level	Distance	Remarks
0.828			14.173	13.345		(SPM 10774)
	1.155			13.018		Staff station A
	1.479			12.694		B
2.121		0.656	15.638	13.517		C (change point)
	1.837			13.801		D
	1.009			14.629		E
		0.428		15.210		F
2.949 -1.084 1.865				15.210 -13.345 1.865		check

Table 4: A sample levelling sheet.

8 Site measurement and depiction

A range of methods and techniques are available for measuring and depicting standing structures and other archaeological features. Traditionally these have focussed on manual methods such as measured drawing. Increasingly archaeologists are making use of electronic distance measurement and digital data capture and visualisation methods for representing archaeologically meaningful details.

8.1 Measured drawing

Line drawing is an important medium for representing standing structures and archaeological sites. The time invested in representing features and relationships by means of a clear and properly scaled drawing is well spent. An aptly done field drawing helps immeasurably in understanding a site and is a vital link between context sheets, field notes, level data and the final report.

Measured drawings are orthogonal projections, i.e. parallel to the plane of the object. The most frequently produced drawings in an excavation are the plan and the section; the plan mapping the view from above and the section mapping the trench sidewalls. Elevations map the vertical planes of standing structures. Small scale site maps and large scale artefact drawings are also orthogonal views.

Basic field drawing kit

sturdy drawing board	stringline level
graph paper (1mm grid)	tape measure/s
plastic drafting film	reel tape
2H – HB pencil/pacer (& refills or sharpener)	Ruler (normal/scale)
plumb bob	

All drawings should contain the following information recorded in the title block.

Project Title:		Project Number:
Trench Number:	Date:	
Scale:	Drawn by:	
Contexts		

A plan must also indicate north, whilst a section must indicate which sidewall is being drawn. A bar scale should be included. Completed drawings should be annotated with basic context information, highlighting important features and stratigraphic relationships where necessary.

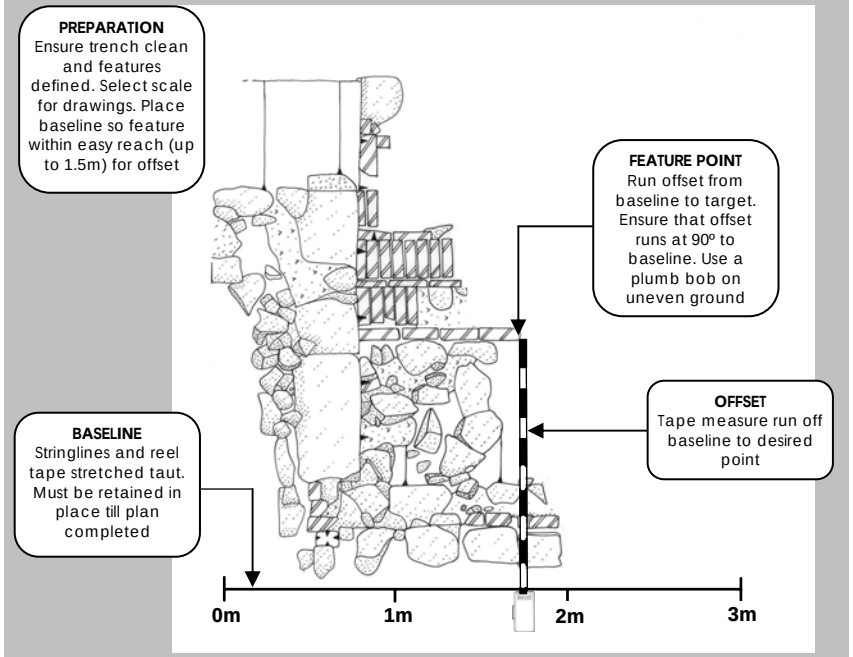


Fig. 16: Baseline and offset basics

8.1.1 Taking measurements

Baseline and offset

The baseline and offset method is the most commonly used method for taking plan measurements on a site or during an excavation (see Fig. 16). It involves establishing a graduated level baseline, usually a tape parallel with the long axis of the site or trench edge, from which measurements at 90° are taken to the point of interest. It is important to make all plan measurements in the horizontal plane. Parallax is controlled using a plumb bob.

Vertical elevation and excavation section drawings also typically use the baseline-offset method. A graduated level baseline (datum line) is established along the elevation or sidewall (usually a levelled string line in combination with a tape). Points on the object face are measured horizontally along the tape and perpendicularly relative to the baseline using a hand tape. All elevation and section measurements must be taken in the vertical plane. Parallax can be controlled using a builder's level. The reduced level of the baseline (relative to AHD) should be recorded on the drawing.

Triangulation

This method is a modification of baseline and offset. Two tape measures are run from different points on the baseline to the target. Ideally the segment lengths should be kept similar. Acute angles should be avoided. The distances (baseline segment and two measured lengths) are plotted on the drawing. Again, all measurements must be taken in the horizontal plane with the aid of a plumb bob to control parallax. The triangulation method is preferable to the offset method where longer distances from the baseline are involved.

Planning Frame

Planning frames are a metric square frame gridded into 10cm windows. When placed over the area to be drawn the features visible through each wire square can be eyed in and plotted. The frame must be level. The method is most useful on surfaces with low relief.

8.1.2 Drawing conventions

Field drawings at Port Arthur are conventionally done with 0.5mm HB/2H pencil on 30micron plastic drafting film over 1mm grid graph paper affixed to a firm but lightweight drawing board. Illustrative conventions are primarily designed to convey stratigraphic and interpretive information (see Figs. 17 & 18). The rendering conventions displayed below are used in both plans and sections (see Fig. 19). They should only be applied at the final drawing stage and not in the field.

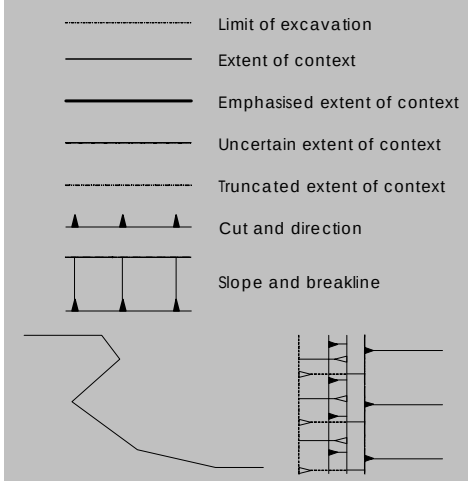


Fig. 17: Line conventions.

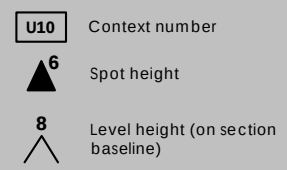


Fig.18: Labelling conventions

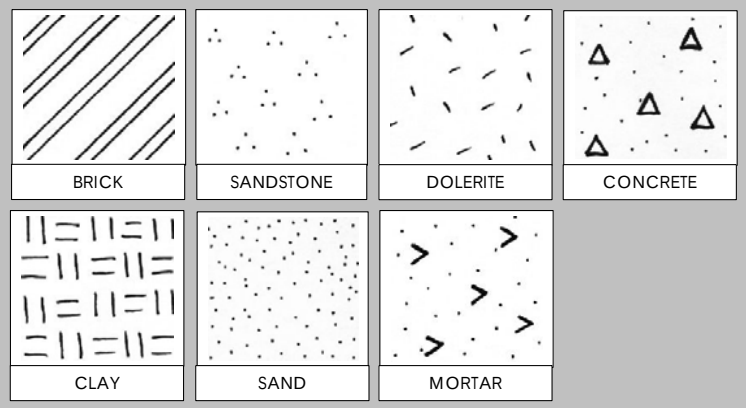


Fig. 19: Common rendering conventions

8.2 Finalising Drawings

Field measured drawings should be cleaned up and rendered for reports and publications. There are two main methods for doing this; hand inking and computer aided design (CAD).

8.2.1 Inking

Whilst laborious, inking is perhaps the more faithful and flexible of the two methods. It involves tracing the field drawing onto clean film with fine-tipped drafting pens. A high level of drafting ability and careful adherence to procedures is essential, as mistakes can be hard to remedy.

Plans and sections should have the minimum necessary amount of pattern detail added, as too much will clutter the drawing. Only commonly-occurring materials require patterning. Context information and other annotations can be added by hand or using adhesive characters.

8.2.2 Computer Aided Design (CAD)

Scanning and heads-up digitising and rendering using a CAD system is a useful way of making drawings electronically accessible and limiting the number of hardcopy drawings that need to be stored. CAD drawings have the advantage of being infinitely editable, and can be produced at any desired scale without loss of resolution. Patterns and annotations can be added easily, and attribute data and links to other databases can be added. A CAD environment allows ready manipulation of the drawing and the generation of 3D models, and allows archaeological information to be seamlessly integrated with engineering and architectural information.

8.3 Photography

Photography is an invaluable means of gathering visual information quickly and accurately. A comprehensive suite of photographs makes data synthesis and reporting considerably easier. Photographs can communicate a lot of information to the reader or viewer.

Four main types of photographic formats have been used at Port Arthur: print, contact, slide and digital. Archaeological images traditionally were captured and stored in B&W contact print and colour slide formats. Contacts enable ease of storage and are a useful quick reference. Prints can be obtained from negatives for B&W reproduction in reports. Slides are easy to store and suitable for presentations. Copies for reports can be made through normal photo-enlargement or scanning processes.

Fig. 20: Elements of a good photograph (PAHSMA 2003)

Fig. 21: Digital SLR camera mounted on extendable rail used for multi-station parallel photography (PAHSMA 2004)

Most archaeological photography at Port Arthur now uses a digital format SLR camera with calibrated lenses. Colour slide photography is also used for presentation purposes, although increasingly is being replaced by digital imaging. Black and white record photography is no longer carried out. The increased use of digital photography has improved the quality and quantity of image information

Digital photography has been used at the historic site since 2000. Up until 2005 it was used in tandem with the other mediums, the quality of the images not considered high enough to be report quality. The limited number of high-quality images that could be stored on a digital camera also lessened their usefulness in the field. The addition in 2004 of a SLR digital camera has however allowed the digital to replace all other forms of photography.

8.3.1 Taking photographs

The procedure for taking photographs is always the same, regardless of format. Photographs must have something in the frame to convey project and context information, orientation, date and scale (see Fig. 20).

8.4 Metric technologies

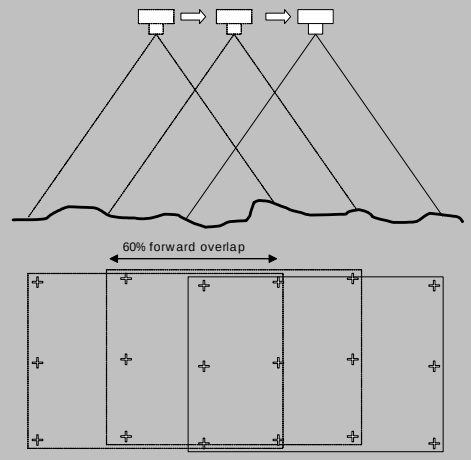
Port Arthur employs a range of image and non-image based metric methods for recording archaeological sites, excavations and standing structures. Image based methods include rectified photography, photogrammetry and orthophotography. Non image based methods include total station detail surveys and laser scanning.

8.4.1 Photogrammetry

Two main forms of terrestrial photogrammetry are commonly used at Port Arthur for recording archaeological excavations and standing structures. Fixed camera stereoscopic photogrammetry is used for recording building elevations and is typically outsourced, while multi-station parallel photography for photogrammetry is done in-house (see Fig. 21). This involves using a single fixed focal length SLR, appropriately calibrated, taking parallel shots from a fixed distance baseline with a minimum 60% forward overlap. While relatively few orthophotos are produced in the general course of a project, the data is captured at critical project stages and archived for future reference (see Fig. 22 & Table 5).

8.4.2 Total station detail surveys

The use of a total station to capture spatial details within a site is an extension of its use in positioning sites within the context of a traverse (see 7 'Site Survey'). It involves selecting points within a site that represent important characteristics (such as excavation limits, feature edges, surfaces and finds), coding and collecting the data points with the



Ascertain job requirements/specifications
Design instrument setup/flight model
Establish and coordinate control marks
Capture imagery/raw data
Check control marks (if necessary)
Process imagery/model
Store processed and raw data

Fig. 22 and Table 5: General process of parallel photogrammetry (also applicable to laser scanning)

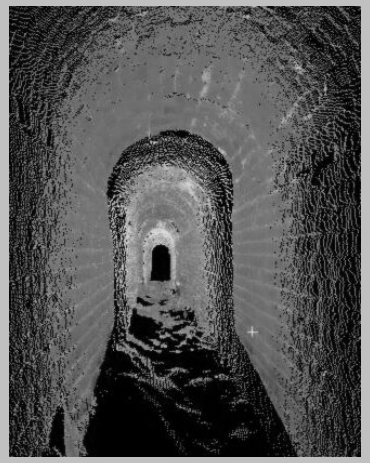


Fig. 23: Laser scanning at 2mm point spacing of subterranean aqueduct. (PAHSMA 2002)

instrument, and finally downloading the data into a CAD or GIS for constructing the relevant points, lines, polygons and surface models. A total station generated model will only be as sophisticated as the initial point coverage will allow, so care should be taken to obtain an adequate and discriminating coverage of all features and surfaces that are to be subsequently delineated and modelled.

8.4.3 Laser scanning

Laser scanners use an advanced form of EDM technology to capture large amounts of highly precise 3D point data. The resulting point cloud, which may also be combined with, or contain, image information provides a highly detailed, if undiscriminating, representation of a complex surface (see Fig. 23). Laser scanning typically uses plane distance measurements owing to its primary use in engineering and construction modelling applications. It been used at Port Arthur in areas of the Site where other methods of recording cannot be effectively undertaken. Its future use on Site for extant recording and structural monitoring is being evaluated.

8.5 Technique selection

The selection of measurement technique depends on evaluation of a number of factors, including the detail and kind of information required, physical space, project resources, skills availability, and ability to manage data. The sub millimetre point accuracy of high resolution laser scanners may be appropriate for recording fine surface textures at the level of a single artefact, but is unlikely to yield important information at the scale of a whole building. Positional data from handheld GPS units may be suitable for 1:25000 landscape mapping, but is not sufficiently precise for recording trench details, and so on. At the end of the day the selection of an appropriate measurement technique should be based upon a rigorous understanding of the archaeological questions, the accuracy, type and quality of the information sought, the level of detail at which the site or feature is to be visually or spatially represented and the requirements and capacity for managing and maintaining associated data and records.

Image-based metric recording

Single image rectification
Single image methods require additional information about the object shape. If the object shape is a plane surface, rectification is possible by simply determining the relationship between the object plane and image plane. The perspective projection parameters can be calculated by four given control points in the object plane. The relative positions of these points in the image must also be measured. Architectural applications also benefit from line parallelism within the object. Simple planimetric restitution methods such as the four point anharmonic and Union Jack methods fit into this general category. Results of image rectifications are simple 2-dimensional image maps. This basic type of image rectification works without metric camera modifications and knowledge of calibration parameters.

Multi-station convergent photogrammetry
Multi image photogrammetry utilises convergent exposure arrangements, with object co-ordinates being computed by intersection methods. An object is completely covered by an image bundle and the photo positions are calculated by best-fit resection algorithms. There are no limitations to camera positions, although site conditions and output requirements will suggest optimal arrangements. Multi image photogrammetry supplies geometric object information with reasonable levels of accuracy and reliability. The typical products, when processed within a CAD environment, are restituted 2d photo-maps, simple 3d-computer models, and reasonable quality large-scale line drawings. Convergent photography is not suitable for detailed DEM production or the accurate representation of non-uniform planes. This form of photogrammetric recording is becoming increasingly popular for basic architectural modelling.

Stereoscopic Photogrammetry
This system, essentially unchanged in principal since its 19th century origins, utilises stereoscopic image pairs corresponding to the human system of vision. Modelling of the object is via disparity or parallax measurements. Use of a stereoscopic viewing system linked to a plotter enables visual evaluation and transcription by driving a floating mark in the stereoscopic model. Advances in digital technology have enabled sophisticated and expensive optical and analogue equipment to be largely replaced by soft-copy systems that achieve automatic object reconstruction by means of pixel correlation. Stereoscopic systems result in high accuracy line drawings, contour plots and DEMs of complex surfaces, but have substantial system investment costs.

Digital Elevation Models and Orthophotos
By combining the principles of epipolar geometry and automatic image correlation, softcopy photogrammetric systems are able to construct DEMs from stereopairs. These DEMS may be produced in either vector or raster forms and have potential applicability in volume determination, 3-D modelling, and deformation monitoring of archaeological surfaces. Photo-textures can be mapped to the DEM by a process of ortho-rectification, or an orthophoto, or 2-D planimetrically correct photo, produced. Orthophotomaps based on aerial photographs have been used in Australia since the early 1990s and are a useful aid to landscape archaeology. DEMs and orthophotos have enormous potential to facilitate CAD and GIS applications and the development of archaeological resource management databases.

Non image-based metric recording

Laser scanning
Laser scanners are a development of optical/electronic technology and use a high intensity pulse directed towards a reflectorless object, the return pulse providing a distance from the device itself. A rotating mirror directs the internal laser range-finder transmitter beam over a precise angular pattern, with the resulting range measurements comprising a point cloud whose precise 3-D coordinates relative to the instrument can be calculated. The grids generated by terrestrial laser scanners are irregular, the X and Y spacing depending on the distance and direction between the instrument and the object point, making it possible to manage the density of the point cloud/grid by simply changing the acquisition distance. Individual models are correlated to remove dead ground. The resultant DEM can be draped with photo-textures to enable creation of a fully rendered 3-D model, or 2-D orthophotos of any desired elevation.

Ongoing advances in scanner technology in areas such as colour capture and high speed dynamic imaging will make high precision portable laser scanning a reality, ushering in a new era for recording archaeological sites and finds.

9 Standing structures

The recording of standing structures is a complex task, requiring a rigorous and systematic process for maximising information whilst minimising subjective judgement. The structure recording system developed for Port Arthur comprises a comprehensive descriptive and analytical framework that is based on the principles of single context planning, stratigraphy and site formation, and is not reliant on a high level of architectural training or skilled drafting ability.

The system is designed to integrate data from various sources, including in-situ contexts, collection items and historical plans, photographs and other documents. The structure recording system consists of three inter-related components:

- **structure elements**
- **surface treatments**
- **structure evolution analysis**

9.1 Structure elements

For the purposes of this manual a structure element is defined as a component part of any structure. It includes:

- Elements *in-situ*
- Elements no longer *in-situ* but for which there is physical evidence of their previous existence;
- Elements no longer *in-situ* but for which there is documentary, oral or pictorial evidence of their previous existence.

Individual structure elements (or contemporaneous groups of identical elements) are recorded on Structure Element Data (SED) forms, which are numbered consecutively for each structure. Elements recorded in collections and from historic sources are completed in the same way as for *in-situ* elements.

Structure element attributes and immediate stratigraphic relationships are documented on the SED and sketched at scale on the reverse (see Fig. 24). Additional drawings and photographs are also referenced on the form.

If a sample is taken it is labelled and accessioned in the same way as any other archaeological artefact together with the SED reference. A maximum sample length of 500mm applies in the case of uniform elements. Non uniform sample elements should be retained entire.

PORT ARTHUR HISTORIC SITE MANAGEMENT AUTHORITY
Structure Element Data Sheet

Project #: *05/01*

Sheet #: *26*

Structure:
Rotten Row, Cascades

Element Name:
Floorboard

Area/Space:
S1, Front NE room

Provenance:
Patch of 6 identical boards in NW corner of room

Fabric:
Wood - worked (hardwood - eucalypt)

Features:
Tongue and groove hardwood, 150mm x 20mm section, circular sawn. Stencil (Chesterman) underneath

Finish:
Undressed, with evidence of japanning and later linoleum cover

Attachment method:
Steel rhomboid head wire nails

Condition:
Deteriorated (weathered and decayed with evidence of substantial borer activity)

Context is physically under	28	29	30					
Context is physically above	11	22						
Context physically abuts								
Context is correlated with	23							

Structural Evolution Data Sheet #: *5*

Drawings: Photographs: Catalogue:

Fig. 24: Structure element data sheet

Structure element data forms, whether samples are taken or not, are indexed and stored within a Structure Element Data project for each structure/asset in accordance with project file management procedures.

9.2 Surface treatments

Surface treatments refer to all the deliberate finishes on the surface of a structure element. These include paints, limewashes, distempers, stains, stencils, varnishes, waxes, papers, fabrics and any other covering or coating.

Successive applications of finishes result in a layered sequence of surface treatments analogous to an excavation stratigraphic sequence. Surface treatment sequences are recorded on a standard Surface Treatment Recording (STR) form which is referenced to the SED form to which the surface treatment relates. The form is stored within a Surface Treatments Record project for each structure/asset.

Although a number of methods for investigating painted finishes have been used at Port Arthur in the past, the principal steps are as follows (see Table 6).

1. Undertake research to understand the evolutionary history of the building
2. Select sample sites that will reveal the relevant sequences and schemes
3. Take small discrete samples and identify stratigraphy by microscopic analysis
4. Make surface scrape on relevant structure elements. The scrape should be exposed to UV light for a period of time in order to clean up the colour
5. If resources permit and where essential, pigment and media identification may be carried out using microscopical, and microchemical techniques
6. Approximate colour matching may be carried out with reference to standard colour charts
7. Where repainting is proposed, the scrape colour should be compared with trial batches made up using the identified materials

In general, steps 1through 4 and 6 are carried out as a matter of routine where simple colour matching is required for building maintenance. The process is clearly iterative, with stratigraphic information from each sample feeding back into the evolutionary

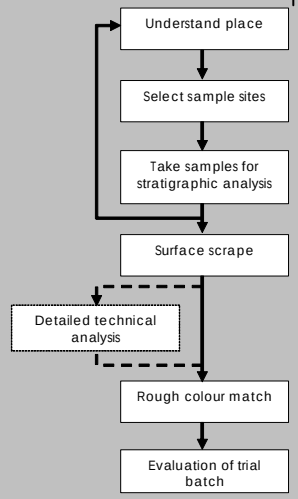


Table 6: Method for investigating paint finishes

Sampling tips:

Paint. Take samples for microscopic examination from discrete areas likely to have the most complete surface treatment history relevant to the study. A sharp scalpel is useful for taking samples from timber or plaster. Resin-mount the sample and plane smooth the cross-section for microscopic examination and photography.

For colour matching a window scrape is generally necessary. A sharp scalpel or small rotary hobby sander in trained hands can be effective dry methods. Wet methods involving carefully applied paint stripper, or preferably less aggressive solvents such as methylated spirits combined with a little elbow grease, can yield good results. The freshly exposed colours should be allowed to stabilise prior to in-situ colour matching.

Limewash. Good effects can be obtained by poulticing the in-situ surface and recording the layers adhering to it after removal.

Paper. Sufficient paper should be exposed to enable identification of any repeat. Evidence of borders or friezes should similarly exposed. Layered samples should be bagged and sent to a paper conservator for separation and conservation treatment.

In all cases preservation of in-situ resources is most important, so samples should be as small and discrete as possible.

model for the structure, which in turn refines the understanding of sample context and any interpreted surface treatment schemes.

Where evidence of papered finished is revealed in plan or section, considerable care should be exercised to expose, record and if required, sample the surface treatments. For layered paper sequences, samples should be sent to a conservation laboratory for separation and stabilisation prior to analysis.
Sample sites are noted on a map of the sample area on the STR form along with any references to relevant diagrams and photographs. Where colours are referred to it is normal practice to also attach nearest match chips from standard colour charts. Where commercial colour charts are used reference should also be made to the closest standard colour or approximate Munsell value. A full suite of Munsell colour charts are held in the Resource Centre reference collection.

Surface treatment samples are registered in the Archaeological Collections database and stored for future reference within the PAHS Archaeology store.

9.3 Structure evolution

Port Arthur has developed a modification of the Harris matrix system for documenting the evolution of standing structures. The system is detailed by Davies (1987) and summarised below. The aims for recording structure evolution are to collate and communicate information in a transparent and logical way, by:

- describing and depicting the evolution of a structure and/or its immediate environs by articulating data from physical fabric and historic sources using a stratigraphic matrix;
- enabling structural changes to be correlated with known historical events, such as changes of occupancy or function;
- dating elements throughout the structure, enabling reliable conservation and interpretation decisions to be made;
- facilitating discussions between all parties with input into the conservation process, including architects, archaeologists, engineers, surveyors, builders, curators etc.

The structure evolution analytical process is rigorous if a little complex, but should be used where any of the foregoing aims are essential to a conservation project.

9.3.1 Structure Evolution data

Individual structure data recorded on the SED forms is compiled on Structure Evolution data (SEV) forms. All structure elements in a study area are listed together with the physical and documentary evidence for their existence. Observed stratigraphic relationships between elements are also recorded (see Table 7).

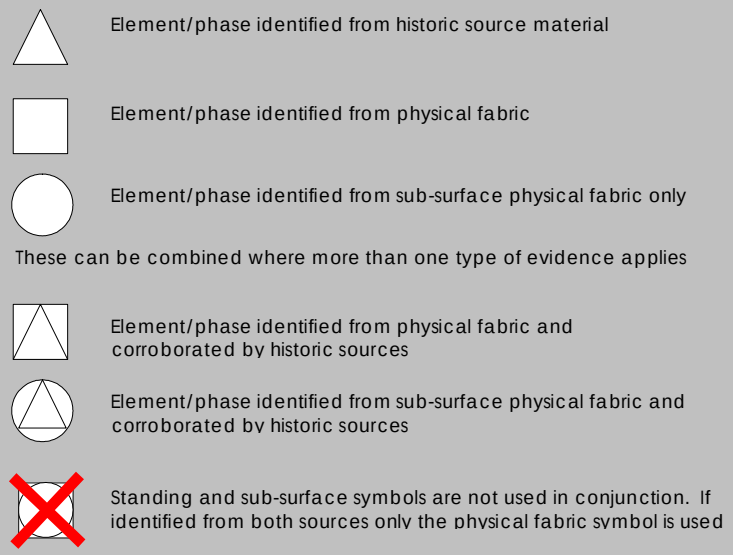


Table 7: SEV matrix conventions

Relationships between SED contexts within an area are expressed in a structure element matrix on the reverse of the SEV form. The matrix is phased, renumbered and symbolised to reflect both stratigraphic relationship and information source.

9.3.2 Structure Evolution Interpretation

For this stage the phased activities, rather than the structure elements themselves, are the critical units. Where standing structure information is to be integrated with excavation data the SEV phases are transferred onto a Preliminary Structure Evolution Interpretation (PSEVI) form.

The phases on the PSEVI form are correlated with the phases derived from any excavations in the area, with both being listed on a Final Structure Evolution Interpretation (FSEVI) form. These are correlated into a final area matrix that again symbolises the evidence sources. There is no PSEVI stage where excavation data are not considered.

The stratigraphic matrix for an entire structure is constructed by amalgamating individual area matrices into a single structure matrix (see Fig. 25). Phases are again renumbered at this point, with Phase 1 being the earliest.

While the system used at Port Arthur is paper-based, it would readily translate to a computerised system.

The structure stratigraphic matrix schematises information that can be critical to the preparation of Statements of Cultural Significance and Conservation Plans. Clearly illustrated evolutionary analyses enable archaeologically derived information to be made accessible to all specialists involved in the conservation of a structure, and allows the impacts of various works or conservation options to be evaluated early in the planning phase.

The structure stratigraphic matrix can highlight questions that require further archaeological investigation or historical research, and is therefore a valuable tool for managing research programs. Constructing a comprehensive stratigraphic sequence for a building provides greater contextual control in fabric and finds analyses, which adds richness to the interpretation of assemblages.

As with Surface Treatment Recording forms, structure evolution documentation is held within a Structure Evolution project file for each structure. SED samples are accessioned into the Archaeology Collections database and stored in the Archaeology Collections Store.

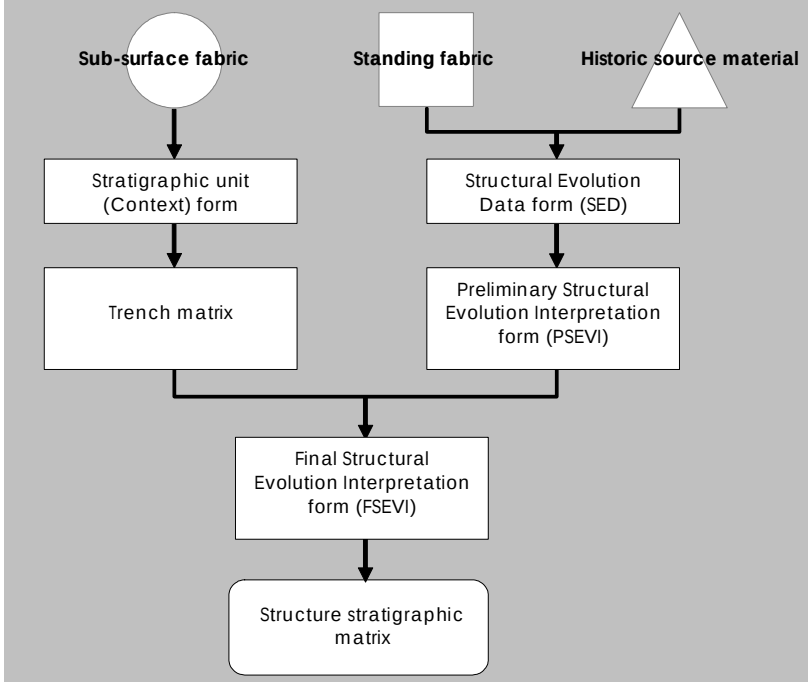


Fig. 25: Structure stratigraphic matrix

10 Excavation

10.1 General principles

Archaeological excavations at Port Arthur fall within two broad categories: excavations carried out in mitigation of works (construction, service installation, grounds maintenance, etc); and excavation undertaken primarily for research. In reality there is considerable overlap between these two categories: a research excavation can be scheduled as part of a works program and mitigation exercises can evolve into larger scale research excavations.

On a dynamic site like Port Arthur, works are continually occurring that require archaeological mitigation. The *Archaeology Plan* establishes the policies that govern such exercises (policies 7.1.4 – 7.1.9, 7.1.14 – 7.1.18). Distilled, it stipulates that archaeological values should be considered early in the planning process along with the impact of works in order to avoid unnecessary damage. Areas of prior disturbance, identified through existing records and discussions with maintenance staff, should be utilised wherever possible when planning new operational disturbances. It is important that cultural fabric is preserved *in situ* unless there is no feasible alternative.

Excavation for research is guided by the framework and policies established by the *Conservation Plan*, *Interpretation Plan* and the *Archaeology Plan* (see Table 8). Research excavations are question driven, concentrating on providing specific information that will enhance understanding, interpretation and conservation management of the site. Archaeological disturbance is kept to a minimum, allowing the possibility of further investigations at a later date. Research excavations mainly occur during the summer months as part of the annual Summer Archaeology Program, although small research projects are carried out at other times as required.

Irrespective of the principal driver behind the decision to excavate, the same fundamental approaches to minimising intervention, maximising data recovery, analysis and reporting of results are followed.

10.1.1 Stratigraphy

An archaeological context is any discrete activity or event for which there is observable evidence. They are the basic observable unit of 'happening' or human behaviour that collectively make up the stratigraphic record of a site. It is generally accepted that there are three types of archaeological context:

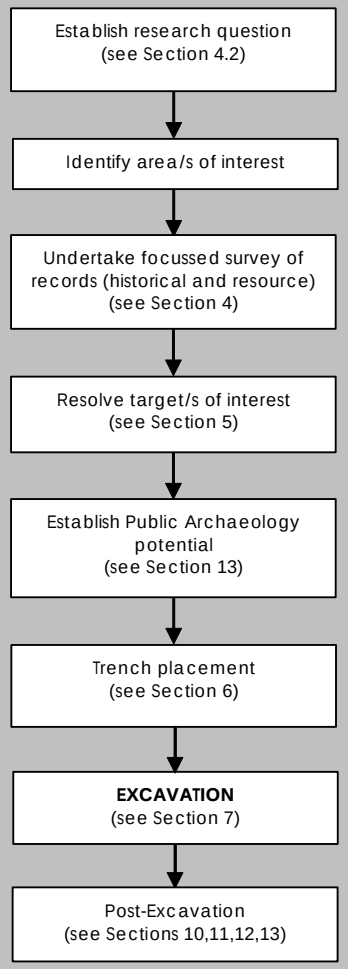


Table 8: Research excavation process

- **Deposits** – which constitute the record of physical accumulation
- **Interfaces** – which constitute the record of surfaces and changes that do not require physical accumulation or removal
- **Cuts** – which constitute the record of physical removal

Each of these types of events either adds physical mass to a site, modifies its surfaces, or takes material away from the site.

The fundamental principle of archaeological stratigraphy is the Law of Superposition, which states that where one deposit overlies another, the upper layer must be more recent than the lower. There are some important provisos however, in the case of sequences that have been reversed through disturbance (Principle of Reversal), or where later deposits are cut into earlier ones (Principle of Intrusion).

For archaeological sites excavated according to stratigraphic principles, each context is assigned a unique number, and excavated/recorded in the reverse order to which it occurs in the sequence: the most recent context is removed first and the earliest context is removed last (see Fig. 26). Stratigraphic excavation allows the archaeologist to physically deconstruct the site, event by event, building up a picture of how the site was formed and how it has been transformed to become the archaeological record we find today.

Archaeological contexts are documented according to the procedures outlined in 'Site recording and measurement'. Relationships between contexts are depicted graphically in measured drawings and schematically in a stratigraphic matrix. A modification of the Harris matrix system is used at Port Arthur.

The Harris matrix system recognises only three categories of stratigraphic relationship; superposition, correlation, and no direct relationship (see Fig. 27).

Each archaeological trench will produce a single matrix. Matrices for multiple trenches are combined to produce a synthetic matrix for a whole site.

At a practical level, and particularly when the vertical extent of a deposit is difficult to gauge at surface, an individual context may be removed in spits, or uniform layers. A spit within one context should never extend into another context; the sole purpose of a spit is to better control the excavation of seemingly homogenous or cryptic deposits. Records and finds from each spit within a single context are re-combined once the context has been completely excavated.

10.2 Types of excavation

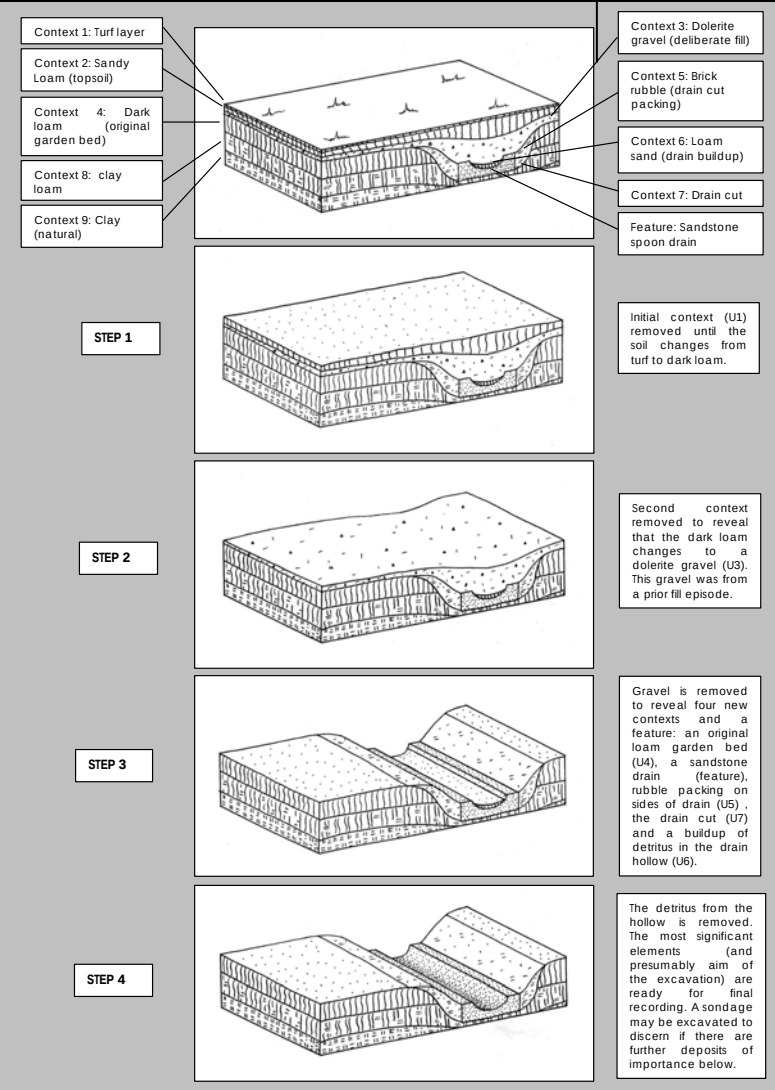


Fig. 26: Example of stratigraphic excavation

Archaeological excavations are carried out in order to gather data from below the surface of the ground. This allows investigation of things that have taken place spatially across a site as well as things that have occurred at different times during the occupation of the site. The type of excavation carried out will therefore largely reflect whether the principal archaeological questions involve investigating spatial or temporal change at a particular place.

10.2.1 Trenches

Trenches, as the name implies, are controlled slices through a site. They are generally square or rectangular in plan, or some even-number sided variation on the theme. Sidewalls are therefore kept at 90° to each other and vertical in profile. They can be any size, but tend to be in multiples of 1m². The principal aim of a trench is to study temporal change by exposing the complete stratigraphic sequence at a particular location. Most of the questions traditionally formulated for Port Arthur involve some aspect of site evolution and are addressed by trenching.

10.2.2 Open areas

An open area is essentially a large trench that encompasses the whole of the site to be investigated. Excavations at Port Arthur rarely use this approach, owing to the primacy of minimising intervention and conserving the bulk of the site *in-situ*. Open area excavations are generally a response to a development and/or rescue scenario; where the scale of the excavation is determined by the parameters of external impacts. This is rarely the case at Port Arthur, although rescue excavations do occur on a smaller scale where development disturbance is unavoidable. Open area excavations have advantages over trenching in terms of recovering horizontal spatial information and lining areas across a site, but universally at the expense of increased site destruction.

10.2.3 Horizontal control of finds

Irrespective of whether excavating is done by trench or open area, it is customary to subdivide the excavation to assist in mapping the spatial distribution of finds. Where contexts extend over a large area it can be helpful to record the location of finds to the nearest square meter. In some cases it may be meaningful to obtain a full 3D spatial reference for each artefact to the nearest centimetre. In most cases however it is found practicable to subdivide the excavation area into 1m squares referenced to the southwest corner of each trench for controlling the location of finds.

10.2.4 Sub surface sampling

Subsurface sampling is essentially test trenching on a small and dispersed scale. Often involving small shovel test pits or soil cores, subsurface sampling is often undertaken for the purpose of investigating spatial patterning where open area excavations are not

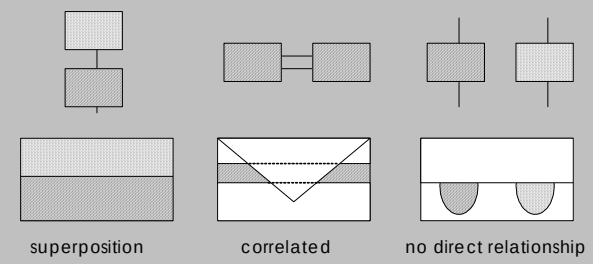


Fig. 27: The three categories of stratigraphic relationship according to the Harris matrix system of recording.

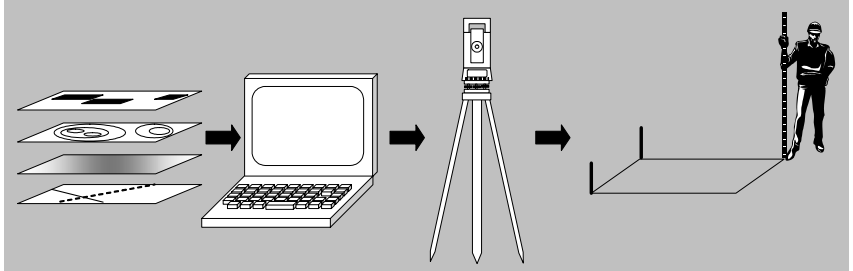


Fig. 28: The steps in the process of setting out an excavation area.

warranted. Depending on the nature of the target, this may involve either a systematic or selective sampling strategy. Selective soil coring may be useful in tracing a linear feature in the landscape, such as a buried path, whereas systematic shovel test-pitting may be useful in identifying the layout and composition of an historic garden.

The typically large number and dispersal of subsurface sample sites within a single investigation makes it imperative that the data is properly coordinated, both spatially and interpretively. When captured precisely and combined with other information, such as geophysical data, within a GIS environment, subsurface sample data can yield a great deal of information for relatively little physical impact.

10.3 Setting out excavations

Whether it is a single trench, an open area or series of small test pits, it is essential to accurately set out the excavation area in order to capture the desired sample of archaeological data (see Fig. 28). This involves interpreting and synthesising a number of different primary information sources, including historical maps and plans, geophysical surveys, aerial photographs and modern management maps. Failure to integrate all available documentary evidence may mean that one of the reasons for siting the trench is flawed. It is very easy to place a trench to intersect a feature on a historical plan only to find that the scale of the plan is incorrect or that the site has since been disturbed.

PAHSMA uses a GIS (Geographic Information System) to bring together primary map information for planning excavations. Once a suitable target area for answering the specific research question has been identified within the GIS, trench locations are delineated and the coordinates uploaded into a total station for setting g out on the ground. Once set out, usually only a small amount of fine tuning is required to square up the excavation areas prior to works commencing.

The reverse process is undertaken at the end of the excavation, with all trenches recorded using a total station and reintegrated into the GIS as the final trench plan. It is important to remember that any data produced from, or designed to be used in a GIS environment will use scaled measurements, so the relevant scale adjustment factor may have to be taken into account when setting out.

10.4 Excavation recording

Archaeological excavation is a destructive process; a site can never be dug in the same place twice. It is imperative therefore that strict rules for recording and documentation are adhered to in order to produce a consistent standard of information from the excavation while it is taking place. An account written up from memory is no substitute for a comprehensive and contemporary excavation record. Archaeological excavations at Port Arthur generate a standard set of records:

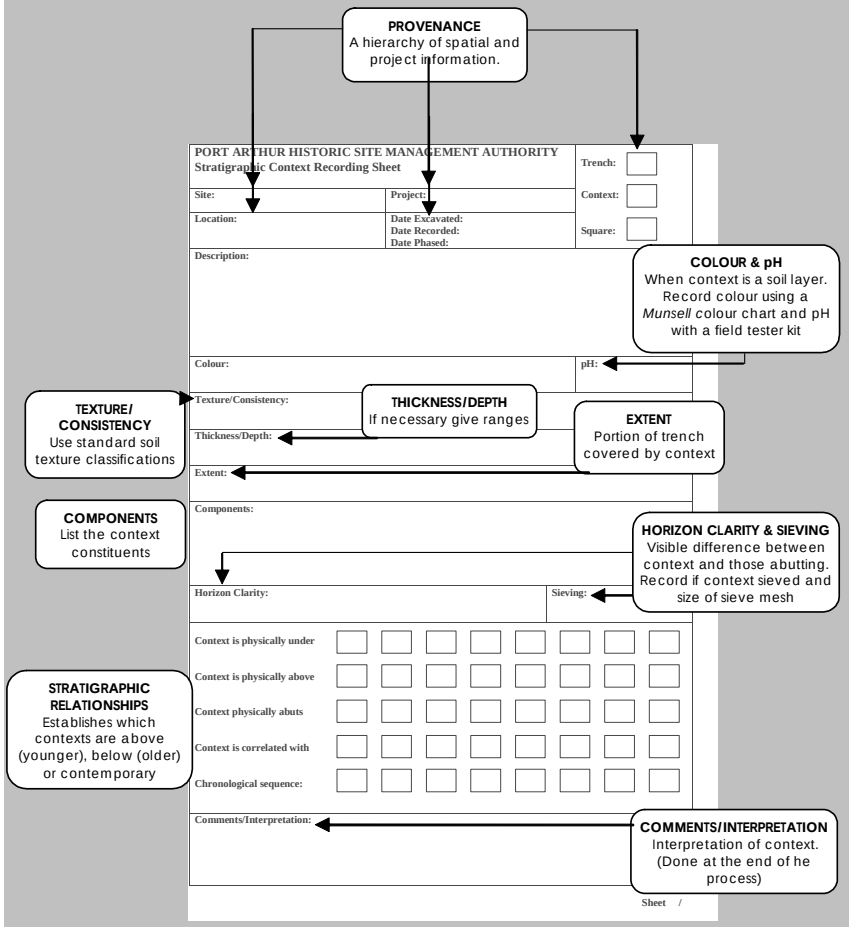


Fig. 29: Obverse of stratigraphic recording form.

- Stratigraphic record sheets
- Field diary
- Level records
- Drawings
- Photographs

These data encompass the details of the excavation process, observed results and interpretation of evidence. They are usefully coordinated by means of a checklist (see 10.4.6 'Checklist'). Collecting a standard set of primary records not only makes it possible to write a thorough site report, it also facilitates intra-site comparative study and makes all of the results of the excavation available for re-interpretation.

10.4.1 Stratigraphic recording sheets

The stratigraphic context recording sheet is the fundamental unit of archaeological recording. Each sheet should describe the physical attributes of the context and defines its relationships with other contexts, generally supported by a sketch plan on the reverse side (see Figs. 29 & 30). The stratigraphic context sheet is the empirical record of the excavation and one must be completed for each context.

10.4.2 Field diary

Whilst the context sheet constitutes the raw record, the field diary is where the site story takes shape. The diary is the place where actions, observations, descriptions and thoughts come together. Details of the process and progress of the excavation are recorded. Observations are interpreted, hypotheses generated, tested, and revised. The field diary is the record of the archaeological process, and the key to making sense of all the primary records.

Each trench or excavation area will have its own field diary, and each day's entry will be prefaced by the following information:

Project Name	Project Number	Date and Day	Notetaker

The function of field notes is twofold; to document actions and observations, and to make and test interpretations. The fundamental divide is between describing what is happening and working out what it means.

Describe process	• What is the location, size and shape of the trench? What depth has it reached? What external factors are influencing the excavation process?

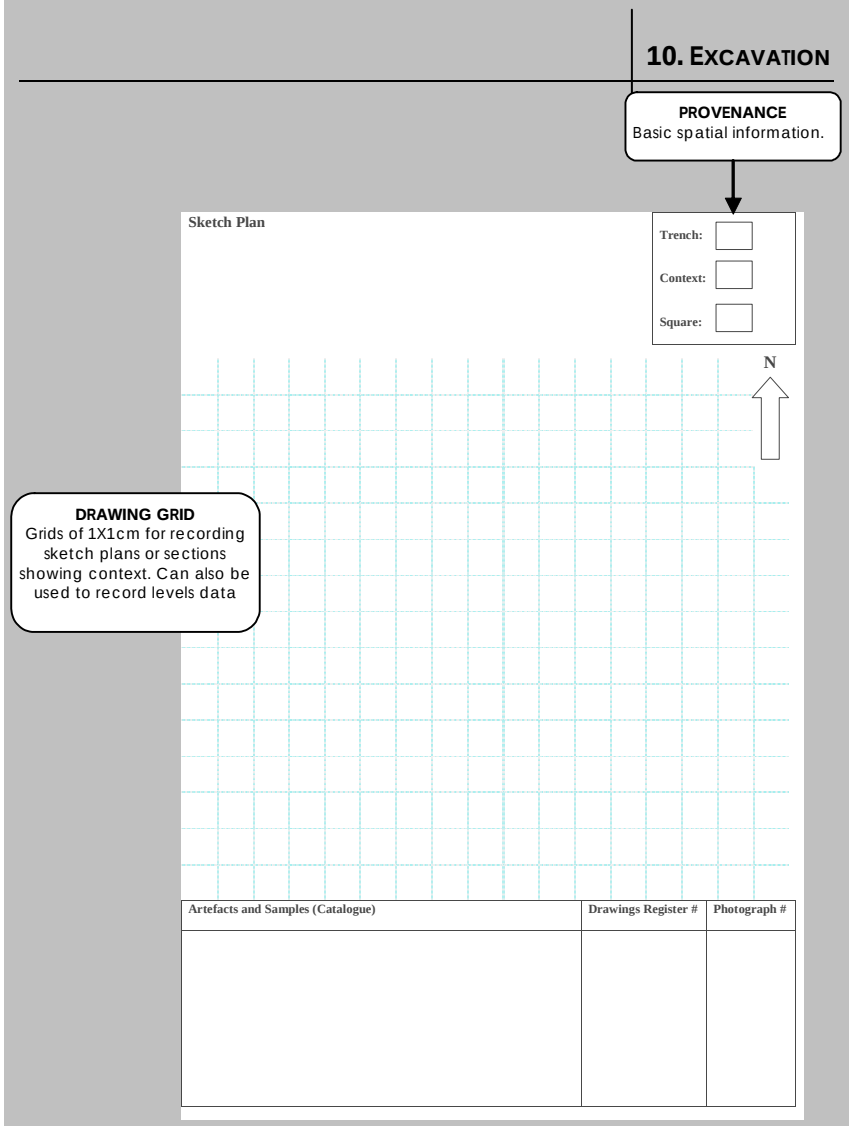


Fig. 30: Reverse of stratigraphic recording form.

	• Who is doing what and where? What contexts have been removed since notes were last taken? • What problems have been encountered with the excavation, and what has been done to resolve them? • What kinds, quantities and TPQ dates of artefacts are emerging? • What kinds of records or samples are being taken? Are here any departures from standard procedures? • Draw progressive sketches ('mud maps') of the trench as work progresses depicting key features and stratigraphic relationships. • Are there any HR issues, such as accidents or incidents that might require additional documentation?
Interpret	• Do the contexts within this trench appear to relate to those found in other trenches? What plausible explanations could there be for any similarities or differences? • What kinds of human behaviour or natural processes could have produced the observed features and deposits? When might these have occurred? • What kinds of tests can be generated that would distinguish between the different interpretations? What were the results of these tests? • Is this excavation providing the evidence necessary to answer our research question? Where else should we look?

10.4.3 Level records

Levels are taken throughout an excavation to provide basic height data on features and surfaces (see Fig. 31). The information is recorded in two places. Observations are recorded on a levelling sheet, and reduced levels are copied onto a sketch map on the reverse side of the context recording sheet.

10.4.4 Measured drawings

While individual contexts are sketched on the context recording form, measured drawings are done more carefully and judiciously. Plans are drawn when required, normally when important horizontal stratigraphic relationships or structures are evident, while sections are normally drawn at the end of the excavation. See 8.1 'Measured drawings').

10.4.5 Photographs

Whereas a measured drawing will record the excavation at a chosen moment in subjective detail, photographs record the actual progress of the excavation – context by context. Archaeological photographs should be orthogonal – which in most cases means taken from an elevated position, and should focus on the contexts or relationships of interest. They must also contain a minimum amount of provenance

Fig. 31: taking levels is a vital part of excavation recording. (PAHSMA 2005)

information. It is also useful to take general shots of both the excavation and the excavators. These shots are handy for reports and publicity. See also 8.3 'Photography').

10.4.6 Checklist

Because of the large amounts of diverse data and information generated by archaeological excavation, it is important to use a checklist to keep track of the record and identify any gaps. The checklist will normally contain fields for context sheets, drawings, photographs, samples and any other data or products produced from the field component of an excavation project. This checklist can prove invaluable when processing the archaeological data and writing the site report, sometimes months or years after the excavation has been completed.

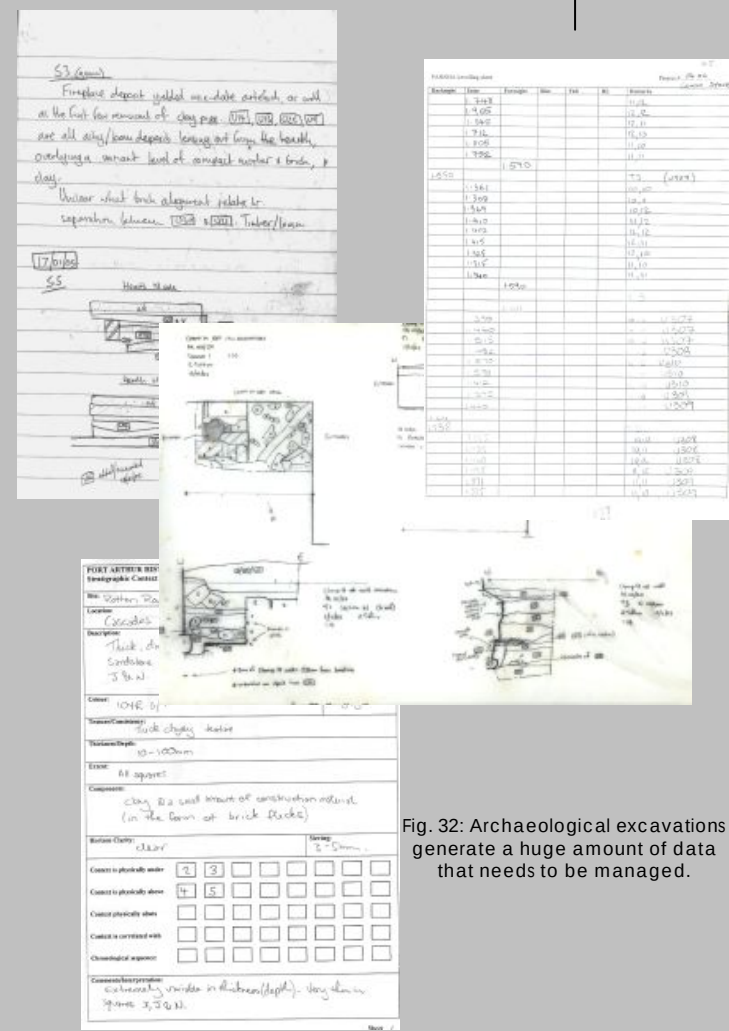


Fig. 32: Archaeological excavations generate a huge amount of data that needs to be managed.

11 Finds and Collections

Most excavations result in the recovery of artefacts. The quantities and condition can vary greatly, depending on the type of site and its preservation environment. There is a standard procedure at Port Arthur for handling and processing finds. The process below is distilled from the *Port Arthur Lab Procedures Guide* (2003), which should be consulted for a more detailed treatment.

11.1 Field bagging

Artefacts must retain provenance information to have any meaning in analyses and interpretation. Artefacts from each context are bagged and tagged in the field before being taken to the laboratory for processing. Each bag must contain a minimum set of provenance information (see Fig. 34). This information is recorded on a waterproof tag placed inside the bag.

11.2 Cleaning

Cleaning can be important for both the proper identification of artefacts and their long-term curation/conservation. All artefacts should be cleaned unless this will harm the object or result in the loss of potential information, such as organic residue. Cleaning should take place in a controlled environment; normally the archaeology laboratory.

Cleaning can include wet or dry-brushing. Dry-brushing is reserved for metals and artefacts that might be damaged by wetting, such as bone and fibre fabrics. Durable materials, such as ceramics and glass are washed and wet-brushed. Cleaned artefacts are arranged on a drying rack within their context assemblage.

11.3 Sorting and Re-bagging

Cleaned artefacts are sorted and bagged only when completely dry. Artefacts within each context are firstly sorted according to gross fabric type (see below). Further classification is not generally carried out until the cataloguing stage. Fabric-sorted assemblages are re-bagged and tagged (See Fig. 35), before being placed in a larger bag for each site context.

Tags, bags, inks and markers must be archival quality, acid free and not break down or give off compounds that may harm the artefacts.

Fig. 33: Good collections' management begins in the field. (PAHSMA 2004)

PROJECT NO

PROJECT NAME

TRENCH SQUARE CONTEXT

DATE

Fig. 34: Data to be recorded in the field.

Ceramic	• pottery • clay smoking pipes
Glass	• bottle/container glass • other glass • window glass
Metal	• iron, copper, lead etc. • composites • unidentified
Faunal	• shell • bone • worked bone and shell objects must be placed in the 'Miscellaneous' category
Miscellaneous	• This will potentially include a wide range of materials: brick and plastic, worked stone and organics, such as wood, leather, shell and bone, etc.

The sorted, tagged and double-bagged, artefacts are placed in project/trench-specific archive boxes. A label must be attached to the each end of box with the information: project number, project name, fabric classes, status of cleaning and sorting, and date of boxing.

11.4 Cataloguing

Effective cataloguing produces a comprehensive record of the artefacts recovered during an archaeological excavation, and provides the basis for site analysis and comparative research. The Port Arthur archaeology catalogue is an electronic relational database that serves as an accession catalogue, an analytical tool, and a collections management system (see Fig. 36). It contains not only the minimum amount of information (provenance, fabric and quantity) but also information on form, function, manufacture, date, use and modification. It is designed to be used by individuals familiar with advanced artefact cataloguing protocols.

The data entry screen is divided into two. The top section is where provenance and broad artefact descriptions occur. The bottom section contains more specific information. To ensure uniform terminology, most of this information is selected through the use of pull-down menus. These menus are fully editable, project names and numbers are easily added. Edits must be approved by the lab supervisor.

Fabric sorted assemblages are broken down to the level of individual objects, or groups of identical objects based on the catalogue fields. A tag bearing the catalogue accession number must be completed for every accession 'item'. This is then re-bagged before being placed back into the original context fabric bag and box from which it was taken.

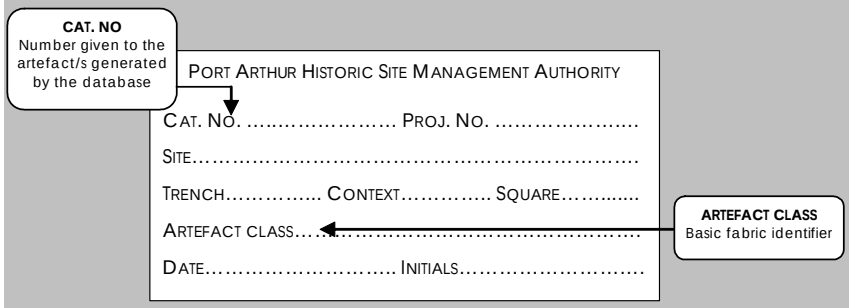


Fig. 35: Tag included with sorted and catalogued artefacts.

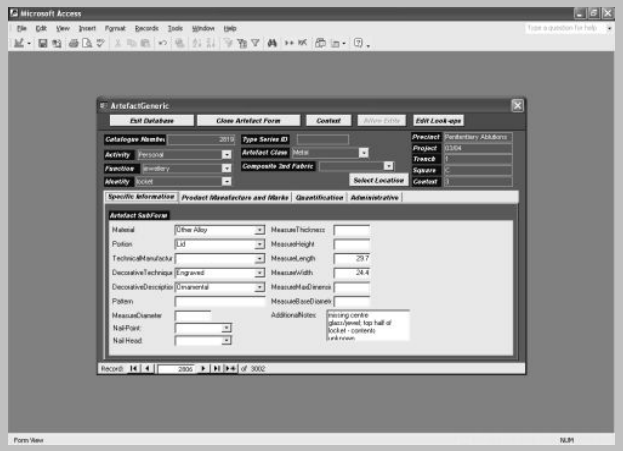


Fig. 36: Port Arthur's database has been specially tailored to suit the archaeologists' needs.

11.5 Collections storage and management

Labelled boxes of catalogued items are placed on shelves according to project in the archaeology store. The boxes are arranged to facilitate curation and accessibility of objects. Boxes containing heavy robust materials are never stored on top of boxes containing light or fragile items.

11.6 Building elements and display items

Building elements recovered during excavation or structure recording are catalogued identically to excavated artefacts. The details of the elements are entered into the catalogue, prior to being tagged and placed in storage.

Items recovered from an archaeological excavation may end up as exhibits in temporary or permanent displays. Though used in a curatorial context, the items remain part of the archaeological collection. When removed form the archaeology collection for display the relevant details must be entered in the archaeology catalogue as well as on the box that they came from. It is important that these artefacts or elements are in a stable condition before and following display.

11.7 Type-Series and Reference Collections

Type-series and reference collections can be valuable aids to artefact identification and cataloguing. Port Arthur has a reference collection for 19th century bottle glass that forms the basis of a catalogue type series. There is no type series used for ceramics as ceramics terminology is more standardised, and applied through the pull-down menu system.

The Port Arthur Resource Centre holds a large collection of reference material to aid artefact dentification.

10.8 Fabric conservation

Fragile artefacts or artefacts recovered from certain environments may need conservation treatment soon after recovery. This is often also the case for items that will end up on display. Port Arthur does not currently have materials conservation facilities. Artefact conservation is outsourced to specialist facilities in Tasmania or interstate.

Basic first-aid procedures should be followed when dealing with finds that require urgent conservation treatment. The key to emergency treatment is to effect as little change as possible to the environment of the object. Keep the object stable, and minimise the potential for structural or chemical change. Professional assistance should be obtained as soon as possible.

Fig. 37: Artefacts provide an immediate and often poignant link to the past. (J. Steele, 2004)

12 Maritime Archaeology

In many ways the Tasman Peninsula, and in particular its expression of the convict system, can be considered a maritime cultural landscape. Over a dozen historical coastal settlements and the remains of innumerable jetties, wharves and coast-oriented goods handling infrastructure testify to the important role the sea and shipping have historically played in shaping the culture and economy of the region.

The PAHSMA is directly responsible for managing three coastal convict settlements, which incorporate the remains of more than a dozen wharf and jetty sites. PAHSMA has been involved in the survey and management of many more in conjunction with the Tasmanian Parks and Wildlife Service.

Most of the principles outlined in previous chapters of this manual apply to Maritime archaeology, although a number of the techniques require modifying to suit underwater conditions. Underwater operating competencies and maritime archaeological training are also essential. In general, while terrestrial historical archaeologists may have suitable skills for working on exposed coastal sites, underwater archaeology should only be carried out by suitably qualified professionals. PAHSMA engages consultant maritime archaeologists for all projects with an off-shore component.

12.1 Basic procedures

The procedures for carrying out maritime archaeology follow the generic archaeological process of background research, formulating questions, identifying areas of interest, resolving targets for intensive study, fieldwork and recording, conservation of finds, reporting and publication, archiving of records, and site conservation and management.

PAHSMA has supported a number of maritime archaeological studies at Port Arthur and other convict sites on the Tasman Peninsula. The Port Arthur (Carnarvon Bay) survey used a range of remote sensing techniques, including magnetometry, bathymetry and side-scan sonar, to identify and classify open water dive targets for circular searches (see Fig. 38). The near shore zone was surveyed using closely spaced swim lines, or systematic transect surveys. The baseline offset method is suitable for positioning features within swim lanes, with more detailed recording done by triangulation or with reference to a demountable measuring frame.

It has been found practicable to spatially locate features on or close to shore in up to 6m of water using a total station and extendable prism pole.

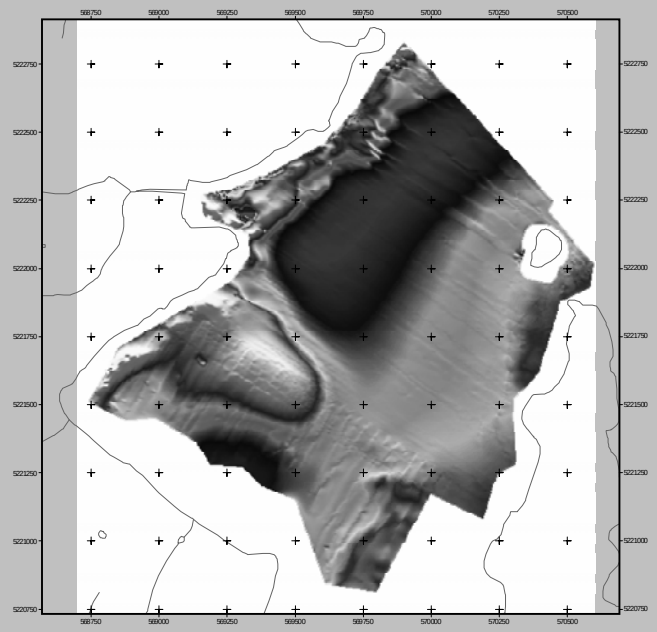


Fig. 38: Magnetometer survey of Carnarvon Bay.
(C. Coroneos 2001)

Excavation on selected maritime archaeological features utilises a small water dredge. Significant features and all excavations are recorded using still and movie digital cameras.

All records, swim lane survey sheets, reports and digital imagery are collated within the relevant maritime archaeological project file and archived in the PAHS Resource Centre.

12.2 Project rationale

PAHSMA does not have direct management responsibility for submerged archaeological heritage. The boundaries of the PAHS ends at the low water mark. This captures the majority of convict wharf and jetty abutments within the local area but does not incorporate moorings, ballast mounds, submerged piles, wrecks, lost cargoes or other cultural deposits. These occupy Crown Land and are managed by the Parks and Wildlife Service. The PAHSMA works closely with Crown Land Services and the Parks and Wildlife Service to identify areas of maritime archaeological significance or sensitivity, and assist in their management. As a general rule however PAHSMA does not take an active role in investigations aimed specifically at research, or for interpretation and tourism purposes.

Where PAHSMA operations have the potential to impact on maritime archaeological resources adjacent to reserved lands, such as through jetty construction or coastal erosion rehabilitation, an archaeological impact assessment must be carried out by a suitably qualified maritime archaeologist.

Fig. 39 & 40: The waters around the Tasman Peninsula are littered with remnants of the convict past. These sites require the same level of care as their terrestrial counterparts. Top and below: copper sheeting and fly wheel lost of the convict dockyards. (C. Coroneos 2001)

13 Aboriginal archaeology

The timing of first Aboriginal occupation of southeast Tasmania is not known. Radiocarbon dates have been recorded indicating Aboriginal occupation of the west coast and central south regions before 30,000 years BP, while in contrast dates from inland east coast sites have not exceeded 4500BP. Earlier dates have been recorded for coastal middens, including 7500BP at Apollo Bay on Bruny Island, while a date of c.5400 has been reported for Low Point on the Tasman Peninsula west coast.

The archaeological record of the Tasman Peninsula suggests a late Holocene mixed Aboriginal economy linking coastal and inland sites. Substantial quantities of flaked stone occur in medium energy coastal sites, while shellfish remains occur in rockshelters up to 4km from the coast, indicating transportation of both stone and food resources over considerable distances. Art and burial sites on the Tasman Peninsula suggest significant social and economic complexity and the dominance of cultural preferences over simple environmental variables in determining resource and land use.

The distribution of Aboriginal lithic scatters and shell middens within the local area indicates the western shoreline of Port Arthur was a well-utilised corridor providing access between the southern sandstone coasts and forested doleritic hinterland to the north and west. Sites in the Port Arthur locale have the potential to contribute to archaeological understandings of regional Aboriginal culture and economy during the period following post glacial sea level stabilisation at 7000BP.

13.1 Basic procedures

Although PAHSMA has responsibility for managing land which has Aboriginal heritage values, including sites, the management of these sites is not vested in the Authority. Aboriginal sites are managed in accordance with the Aboriginal Relics Act 1975, which is administered by the Aboriginal Heritage Office of DPIWE. Any issues relating to the discovery or management of Aboriginal sites on PAHSMA land must be referred directly to the Aboriginal heritage Office. In the case of indigenous human remains, the Tasmanian Aboriginal Land and Sea Council (TALSC) should also be contacted immediately. Any management assessments or studies of aboriginal sites that are considered necessary must be done by appropriately qualified personnel, usually an Australian Archaeologist in conjunction with an Aboriginal Heritage Officer, in accordance with directives and/or permits issued by the Aboriginal Heritage Office.

13.2 Management rationale

While it is acknowledged that aboriginal heritage within the PAHS has considerable archaeological values, at the present time these potential resources are not available for archaeological study and should be preserved in-situ without interpretation.

14 Archaeological Project Management

Archaeological activities are managed in the same way as any other project. They all require a structured process for managing changes to knowledge and the organisation. In common with all other areas of business, archaeology project management at Port Arthur aims to produce defined outputs by a certain time and to a specified quality for a given level of resources, ensuring that agreed outcomes are achieved.

The PAHSMA approach to archaeological project management is consistent with the Tasmanian Government Project Management Guidelines (March 2005), and incorporates standard planning, risk, quality, resource management, evaluation, reporting and file management components.

14.1 Project planning

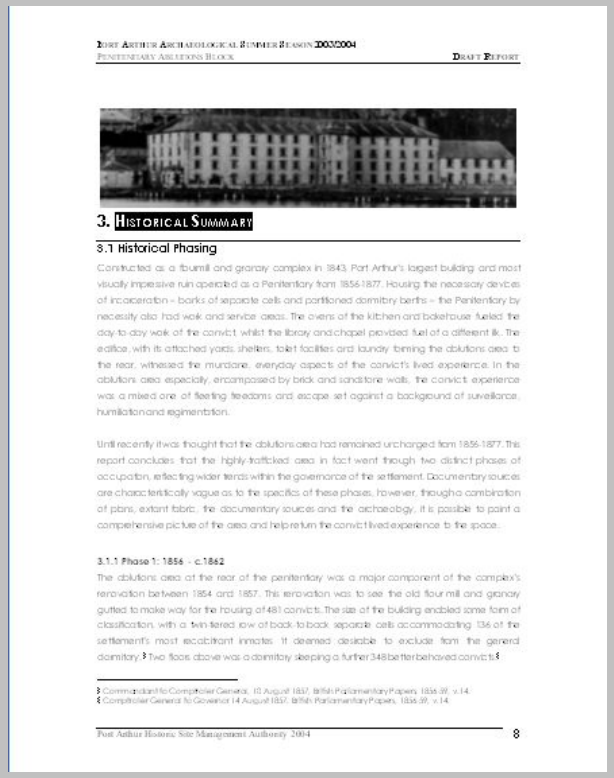
Archaeological projects are scoped and defined consistent with broad organisational objectives and policies. They may originate directly from PAHS Corporate Plan initiatives or from particular programs outlined within the PAHS Conservation Management Framework; in particular the PAHS *Interpretation Plan* and PAHS *Archaeology Plan* (Vol 1). Planning for archaeological projects follows normal procedures; specifying outcomes, milestones and required resources and making use of formal project plans, Gantt charts and other aids to ensure effective project progress and completion. In practice the degree of administrative formality is dependent on the size and scale of the archaeological project; a small in-house monitoring exercise generally requires less formal planning and consultation than a large public archaeology program. In all cases however the same fundamental approach to planning applies.

14.2 Reporting

Archaeological projects can result in a variety of final products or outcomes, but in most cases there will be a site report or other substantive plan or document produced. Sometimes formal evaluation is also required prior to project closure. PAHSMA has developed standard formats for final site reports and major management documents (see Fig. 42). These templates, and their successors, will be adhered to in order to maintain corporate style and informational comparability. Consistency in archaeological reporting is the key to comparative analysis which is essential for improving our understanding of historical processes.

For projects that involve external consents the format and content of final reports will also take into account external reporting requirements. In addition to final reports, selected projects on subjects with a high degree of public interest may be published or otherwise disseminated to the community. The PAHS maintains an archaeology web site for posting summary reports of projects assessed as being of substantial public interest.

14. ARCHAEOLOGICAL PROJECT MANAGEMENT



PORT ARTHUR ARCHAEOLOGICAL SUMMER SEASON 2003/2004
PENITENTIARY ABLUTIONS BLOCK — DRAFT REPORT

3. HISTORICAL SUMMARY

3.1 Historical Phasing

Constructed as a flourmill and granary complex in 1843, Port Arthur's largest building and most visually impressive ruin operated as a Penitentiary from 1856-1877. Housing the necessary devices of incarceration – banks of separate cells and partitioned dormitory berths – the Penitentiary by necessity also had work and service areas. The ovens of the kitchen and bakehouse fuelled the day-to-day work of the convict; whilst the library and chapel provided fuel of a different ilk. The edifice, with its attached yards, shelters, toilet facilities and laundry forming the ablutions area to the rear, witnessed the mundane, everyday aspects of the convict's lived experience. In the ablutions area especially, encompassed by brick and sandstone walls, the convict experience was a mixed one of fleeting freedoms and escape set against a background of surveillance, humiliation and regimentation.

Until recently it was thought that the ablutions area had remained unchanged from 1856-1877. This report concludes that the highly-trafficked area in fact went through two distinct phases of occupation, reflecting wider trends within the governance of the settlement. Documentary sources are characteristically vague as to the specifics of these phases, however, through a combination of plans, extant fabric, the documentary sources and the archaeology, it is possible to paint a comprehensive picture of the area and help return the convict lived experience to the space.

3.1.1 Phase 1: 1856 - c.1862

The ablutions area at the rear of the penitentiary was a major component of the complex's renovation between 1854 and 1857. This renovation was to see the old flour mill and granary gutted to make way for the housing of 481 convicts. The size of the building enabled some form of classification, with a twin-tiered row of back-to-back separate cells accommodating 136 of the settlement's most recalcitrant inmates. It deemed desirable to exclude from the general dormitory:[3] Two floors above was a dormitory sleeping a further 348 better-behaved convicts:[4]

[3] Commandant to Comptroller General, 10 August 1857, British Parliamentary Papers, 1856-59, v.14.
[4] Comptroller General to Governor 14 August 1857, British Parliamentary Papers, 1856-59, v.14.

Port Arthur Historic Site Management Authority 2004 — 8

Fig. 42: The archaeological reports produced by PAHSMA are designed to a standard format.

14.3 Documentation/File management

In addition to generating knowledge, Archaeology also generates significant quantities of data, administrative documents, photographs, illustrations, reports and many other forms of material product. Managing such records is a critical aspect of archaeological administration.

At Port Arthur there are two main administrative contexts for archaeology, - corporate and project. The corporate/project divide is a fundamental principal of the PAHSMA Conservation & Infrastructure Job Costing System.

Corporate activity is effectively 'normal business', and incorporates general tasks and resources that are repeated. These include such as answering public enquiries, preparing monthly and annual reports, and other general management and non-specific heritage maintenance tasks.

Projects differ from normal business activities in that they have a definite start and end, generate new understandings and bring about either cultural or physical change. The documentary evidence of these changes constitutes the project record.

Corporate archaeological information, which may be used for specific projects, including Site surveys, orthophotos etc., are stored in corporate hardcopy and Network directories according to the PAHSMA file management system.

Project information is generated for, or during, specific archaeological activities, and is managed according to a Project File Management Database (see Fig. 43).

The purpose of the Project File Management Database is to ensure that project data and information is properly coordinated and archived to allow ready retrieval. Archaeology is a synthetic discipline, and both corporate and project information is often incorporated into subsequent jobs or analyses, not only to create an evolving picture of historic activity within site and its setting but also to build corporate knowledge and improve management capacity. A robust file management system that is capable of linking textual, image and spatial data is a fundamental element of archaeological synthesis, model building, and resource management.

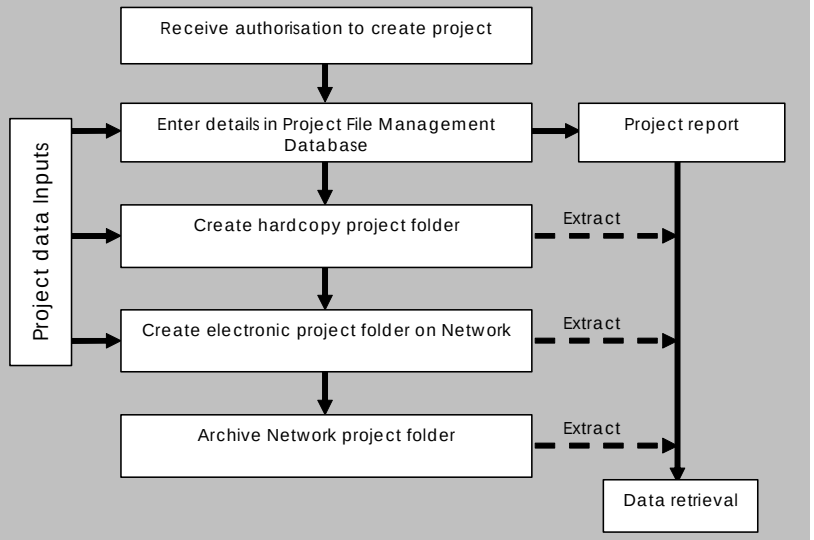


Fig. 43: Organisation of Project Management Database

15 Archaeological Site Conservation and Management

Port Arthur is an archaeological park; a place where archaeology is not only undertaken for abstract research or impact mitigation reasons, but where it is an essential part of conserving and managing the Site. Archaeology at Port Arthur contributes strongly to site interpretation, both in terms of the spectacle and information products of the study process, and also in the way in which sites are physically conserved and presented to the public.

In general, PAHS conservation policies stress the importance of conserving archaeological sites and features 'in-situ' and in an 'as found' condition, unless more active intervention is essential for physical conservation or for understanding and communicating aspects of cultural significance. Destruction of archaeological sites is not permitted unless there is no feasible alternative (see 3.1 'Initial Assessments).

It is generally considered desirable to minimise physical intervention in an archaeological site because all of its characteristics, including its state of deterioration, embody potential evidence of the ways the site has been used and its meanings altered through time. The approach of benign neglect, or simple maintenance, is routinely applied at Port Arthur where sites are globally stable. Where the process of deterioration is resulting in the loss of potentially significant information or damaging other cultural values, and/or that the condition of the site is conflicting with some fundamental communication objective for the place, then some form of intervention may be appropriate to stabilise the site or clarify its message.

15.1 Site maintenance and preservation

Port Arthur uses the definitions for conservation contained within the ICOMOS (Burra) Charter. Archaeological Site stabilisation generally takes the form of maintenance and preservation, and involves offsetting selected effects of natural deterioration and cultural impacts, rather than taking sites 'back' to an earlier perceived state. The impacts of natural deterioration at Port Arthur are remedied through standard approaches to such things as the assessment of decay factors, managing drainage, controlling animal burrowing, maintaining vegetation cover, stabilising retaining walls, managing visitor movement, and reburying exposed fabric (see Fig. 45).

In the case of reburial, care must be taken to make sure that the intervention or introduction of new materials does not do additional harm to the site. It is important to understand the pre-disturbance characteristics of the site, its chemistry, moisture regime etc. and design and implement reburial consistent with sound conservation principles. At Port Arthur, care is taken to select reburial materials that have similar chemical and physical characteristics to the host material. The potential for moisture and oxygen to infiltrate a site following archaeological intervention must be understood and offset

Fig. 44: Deterioration is an important site formation process and must be understood if a site is to be conserved appropriately (PAHSMA 2004)

Fig. 45: Once the required information has been extracted, the sites are re-buried to minimise damage to exposed fabric. (PAHSMA 2004)

where necessary. More active methods, such as chemical and cathodic protection systems may be required, and have been used at Port Arthur, to control undesirable redox reactions after reburial of archaeologically exposed features.

The selection of appropriate compatible reburial materials is critical as Port Arthur has adopted a policy of utilising clean, or at least exotic, materials for site reburial. This facilitates re-identification of the extent of the intervention and reduces the potential for contaminating the site with local excavation spoil.

New materials are separated from in-situ fabric by a felted geotextile barrier, which allows for migration of atmospheric gases and moisture, but prevents physical mixing of soil particles. It also provides a long-lasting and unambiguous marker of the extent of management disturbance for any future archaeologist investigating the site.

15.2 Site restoration and reconstruction

Archaeological conservation often goes beyond the re-establishment of a benign preservation environment, and can involve restoration or reconstruction of original fabric. This is often concerned with communicating a particular message about the site by removing accretions, selective repair, and introducing new elements in with the aim of simplifying or clarifying visual and textural cues about former functions and meanings. All such work must be firmly set within the limits of justifiable archaeological knowledge, and justifications for such work must be soundly based upon the conservation and interpretive policies for the Site.

At Port Arthur a number of approaches have been used in the restoration and reconstruction of archaeological sites. A combination of anastylosis (masonry reassembly) and new steel bracing was carried out on the Point Puer bakehouse to interpret the scale and form of a collapsed underground storage vault (see Fig. 46). The relative mass and unattractive detail of the introduced steel elements compromised the intended interpretive effect however, and the system has not been adopted elsewhere on the Site.

Adaptation of archaeological sites to serve new functions is generally not done at Port Arthur.

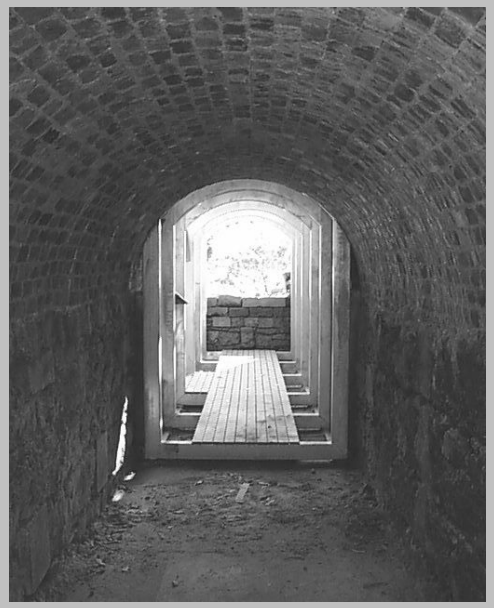


Fig. 46: Restoration and partial reconstruction of the Point Puer bakehouse involved reassembly of collapsed masonry uncovered through careful archaeological excavation, combined with the introduction of new elements, which included masonry and structural steel bracing that aimed to interpret the former extent of the underground food store. (PAHSMA 2003)

16 Interpretation and Communication

Interpreting and communicating are important facets of archaeology. PAHSMA addresses these obligations in a number of ways. Firstly, field aspects of archaeological projects at Port Arthur are on show to the public wherever possible. Secondly, specific public programs are run that actively engage the public through participation in the processes of discovery and construction of meaning of sites and objects. Finally, once the job is finished it is important to present archaeological findings and interpretations to the broader community, both to communicate what has been learned and to allow discussion and reinterpretation of the evidence by others.

16.1 Visible archaeology

The 'doing' of archaeology is the one element of the archaeological process that the archaeologist has full control over and the aspect that can be presented with the least degree of conjecture. Even if the interpretations are contested and the evidence is contentious, the simple act of looking is unambiguous. A person in a trench, looking for evidence to answer a question is about as honest and clear as archaeology gets. This is the level where most visitors to Port Arthur come in contact with archaeology, and the starting point for discussions about what it all might mean (see Fig. 47). Basic signage outlining the history of the site, the principal site-specific archaeological questions and the investigation methods are often provided, and excavators are encouraged to respond to visitor questions and update guiding staff on project progress and findings.

Keeping trenches open to public view for longer periods creates challenges for site stability and maintenance. Chemical and physical deterioration, vegetation growth, burrowing animals and the accumulation of litter and debris must be managed in order to maintain effective presentation and avoid further damage to the site. As a general rule archaeological trenches are backfilled soon after investigation unless there is an overriding interpretive benefit, and effective means of keeping them open for a defined period. Devices for keeping trenches open and on display for longer periods, which may include the use of introduced elements such as sidewall shoring, viewing decks and shelters, are generally not used at Port Arthur, but may be considered under appropriate circumstances.

16.2 Public Archaeology (Jody Steele, Public Archaeologist)

Public Archaeology has been an integral component of the Port Arthur Summer Archaeology Program since 2001. Public Archaeology is designed to share the findings, process and experience of archaeology with visitors to the Site. Port Arthur's public archaeology comprises a comprehensive multi-component program of activities and interpretation, connecting with the interests and experiences of a broad range of

Fig. 47: The actual process of archaeology holds great fascination for the general public and efforts should be made to interpret it. (PAHSMA 2004)

visitors. The program is run by experienced professional archaeological communicators, taking the pressure off excavation staff and volunteers.

Program Components
The following activities are commonly included in Port Arthur's Public Archaeology Program. The list is not exhaustive, and each year the program offerings will be tailored to maximise the involvement or the public in whatever other archaeological activities are happening on the Site.

- Trench-side signage (active excavations)

Signage is designed to answer the questions most frequently asked of archaeologists working on site: 'What are the archaeologists doing?' and 'What do the archaeologists expect to find?' The signs also provide an abridged history of the site, historical images of past structures/surrounds, as well as current finds and interpretations. The signs supply visitors with a basic outline of 'what's happening' at times when archaeologists are not present.

- Archaeology Tours (guided by a archaeologist around active and past excavations)

Archaeology tours are an opportunity to guide visitors through an archaeological process (see Fig. 48). They encompass sites from all phases of archaeological work, from current excavations – enabling explanation of archaeological technique and post excavation processes, through to completed reconstruction projects (such as Government Gardens) – showcasing the relationship between archaeology and heritage management. The tours provide a moving forum for discussion with archaeologists on issues such as policy, research aims and methods, as well as an opportunity to see and handle recent finds.

- Trench-side commentary (discussion with professional archaeologist)

Similar to the tours, yet more focussed on a specific site. The commentary is more place-based and discursive, detailing its uses and changes over time. The static nature of the commentary allows more use of props and images, and typically encourages a more textured discussion of the site history and archaeology.

- Public Excavation (chance to experience archaeology first hand)

A controlled excavation with all sensitivities properly considered can often permit some level of public involvement – varying from excavation to finds processing (see Fig. 49). Trenches selected for public participation should have sturdy structural remains and

Fig. 48: Tours and trench-side talks offer the visitor a chance to engage with the archaeology (T. Owen 2003)

Fig. 49: First-hand contact with the process and results of archaeology is the best way to educate young and old alike. (J. Steele 2003)

robust deposits that can be excavated by inexperienced hands. Public excavations allow visitors to gain practical understanding of archaeological principles and techniques. Prior to excavation, the public are instructed on site rules and restrictions, digging techniques and equipment, recording methods, and artefact recovery and basic processing. This component of the Public Archaeology program is the most popular with younger visitors, being a genuine and memorable hands-on experience.

- Archaeological exhibition (displaying recent finds and interpretations)

While tours and trench talks allow the handling of generic artefact types, archaeological exhibits allows some of the more interesting and unique artefacts to be displayed and interpreted (see Fig. 50). Displays also present the results and interpretations of recent excavations, using text, images and interpretive models.

- Website (dedicated to recent projects and news)

The website was designed for students, volunteers and other archaeologists (see Fig. 51). It provides an overview of site history, the aims of archaeology, and summarises current and completed projects. The website offers an avenue for discussion with the site archaeologists as well as a resource for those interested in the ongoing interpretation and management of Port Arthur's archaeology.

Co-ordinating Considerations

There are five main considerations when co-ordinating a public archaeology program at Port Arthur:

- Audience

Unlike many other archaeological sites, it is not difficult to attract the public to Port Arthur. However, engaging with the public requires a structured and textured approach to communication. In order to compete with other attractions for the attention of busy visitors, signage announcing archaeological activities should be positioned at principal arrival and congregation points. Complementary information should be contained in the site brochure given to all visitors.

Once an audience is gathered, it is important to speak to the archaeological knowledge, interests, and make-up of the group. The tour or talk should be modified appropriately, making use of visitor experiences and perceptions to stimulate discussion. Interacting with the audience, especially children, is usually an effective way to maintain interest and helps in the explanation of sometimes complex archaeological concepts.

Fig. 50: Exhibitions are a quick and relatively easy way to display the results of archaeological research to the public. (PAHSMA 2005)

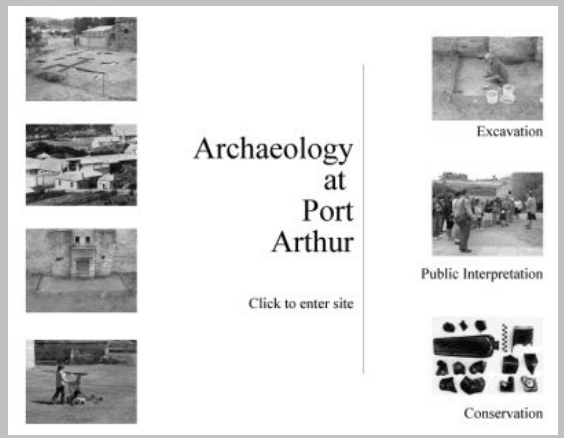


Fig. 51: The internet can be a useful medium for disseminating archaeological information quickly.

- Site Accessibility, Sensitivity & Impact

The accessibility of the location and of routes linking excavation areas or tour sites is an important consideration in selecting sites for public interpretation and involvement. The needs of visitors with restricted mobility should be addressed. The capacity for these areas to hold large groups should also be assessed during program planning.

Site sensitivity is an important consideration. Robust sites are specifically chosen for the public program. The likely stability of structural remains and fragile deposits and features, such as organics, should be assessed in the planning stage. Public safety is paramount, trench sidewalls should be stable and trench depths strictly limited to manage OH&S risks.

Visitor traffic in or around excavation areas can potentially damage sub-surface deposits and create slippery ground conditions. Managing visitor movement by placing barriers around hazardous or sensitive areas and regularly changing tour stops can mediate impacts and risks.

- Project Interest

The communication aims of public archaeology must be carefully considered. Although generic aspects of the archaeology process may often strike an initial chord with visitors, in order to maintain audience interest and involvement in a 40 minute tour or during an excavation, the aims of the exercise and the role of the process, and of the visitor, in achieving those aims must be well communicated. This is easier to do with sites that have highly visible remains and spectacular finds. The 'wow' factors can be important, and may be a consideration in site selection. However if the research question is sufficiently well crafted and the audience needs and interests have been effectively gauged, the skilled archaeological communicator should be able to engage visitors fully in the story.

- Integration with Site operations

It is important to make sure that the public archaeology program is integrated with other Site interpretation, tourism and maintenance operations. Assessing the most appropriate times and routes for public program elements is important in order to complement other visitor activities and avoid timing conflicts. Relevant site staff, including managers, guides and grounds staff, should be regularly updated during the planning and delivery of public archaeology activities.

- Evaluation and follow up

For a program to gain continued public support, a combination of feedback and follow-up is required. Feedback during the tours and talks and through visitor surveys facilitates

16. Interpretation and Communication

Fig. 52: The archaeologist must engage the public whether they are undertaking a tour, public excavation or trench side talk. (J. Steele 2004)

ongoing refinement of public programs, while the progress and results of projects are made available via the archaeology website. This helps to extend the experience of Port Arthur's archaeology well beyond the Site visit.

16.3 Publication and peer-review

Conferences, publication and review are important aspects of creating, testing and communicating archaeological knowledge. The geographic isolation of the PAHS can lead to an insular approach to research. This can be avoided if a procedure of publishing and peer-review is adhered to.

The importance of disseminating information and publishing is recognised in the site's *Corporate Plan* and *Archaeology Plan*, and time to work material up to publishing standard must be incorporated into project plans. The site intermittently releases Occasional Papers, which provide a dedicated forum for recent historical, archaeological and interpretive projects (see Fig. 53). PAHSMA also produces monographs on selected subjects. Current research is presented at conferences and submitted as articles to journals, magazines and newspapers. The internet is also a quick and easy way to disseminate the results of archaeological and historical research, and the PAHS maintains an archaeology website aimed at middle-school level.

16.4 Education and training

The Port Arthur Historic Site is a national leader in deriving public benefit from archaeological conservation. The Site has a long history as a training ground for heritage practitioners and managers, archaeological volunteers and school students.

Opportunities for undergraduate training are closely linked to the field and laboratory components of the annual Archaeology Summer Program. While not a recognised training organisation in archaeology or heritage management, the Site is widely acknowledged as providing valuable opportunities for vocational learning.

The high profile of the Site and extent and significance of its archaeological resources position the PAHSMA as an important player in national archaeology teaching and learning strategies. Opportunities to further develop this potential are being explored through partnerships with Registered Training Organisations, particularly in the Tertiary archaeology sector.

The PAHS has had many successful research collaborations with Australian universities, leading to a range of substantive outcomes in the areas of convict history, archaeology, geophysics and cultural site interpretation. Practical tertiary sector collaborations for future consideration include archaeological field schools, supervised undergraduate placements, post graduate projects, and support for post-graduate scholarships in relevant areas.

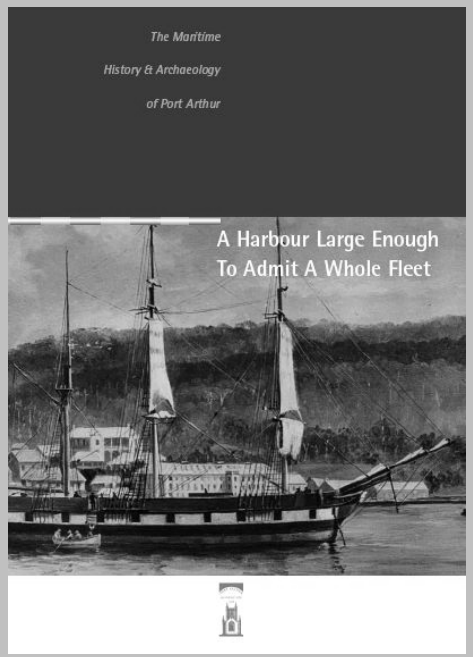


Fig. 53: Hard-copy publishing is the benchmark process for communicating archaeological information and encouraging review. (PAHSMA 2004)

The PAHSMA also provides workplace and volunteer opportunities for history, archaeology and architecture graduates, which ensures an infusion of current ideas into site management while exposing trainees to the legacy of 90 years of reserve management. Industry developments are supported through hosting professional conferences, technical workshops and seminars.

Schools-based learning is addressed through a range of products, including a comprehensive State curriculum-based education program (under development), tailored archaeological activities and student work experience programs.

16. Interpretation and Communication

Appendix 1: Structural Evolution data sheets

Port Arthur Historic Site Management Authority
Structural EVolution Data Sheet (SEV)

Structure *Commandants Res.* | **Area** *S8 and Roofing S7,8,10,11,12* | **Project #** *82/01* | **Sheet #** *001 (1 of 3)*

Element	Physical evidence	Historical evidence	Sequence	Date
1. Roof framing (S7,8,10) – rafter battens, ridge plate, ceiling joists {SEDS 0406, 0407,; plan AEO 82-187]	*Timbers are pit-sawn and attached by square-shafted nails. Members are identical and so form a single construction.*	*Documents mention un-specified additions to house in 1839 (Brand Papers, Vol. 2].* *Plan by Laing (CON 87/1836) does not show these rooms. Sketch of c.1842 shows rooms (H.P.C. 2689)*	*Roof contemporary with wall plates (and therefore with walls)*	*C1839*
2. S8 Chimney {SEDS 0425]	*Mortar does not match S8 walls. Roof rafters around chimney are cut through and supported by propos. Chimney not bonded into wall.*		*Post-dates S. wall. Probably introduced when door-way was blocked in W. wall of S8 and when S8 cross-wall was demolished (i.e. when S5/6 was constructed).* *See SEV data sheets 010 & 013 – sequences for S5/6/8/11/12*	*c.1844*

Port Arthur Historic Site Management Authority
Structural EVolution Data Sheet (SEV)

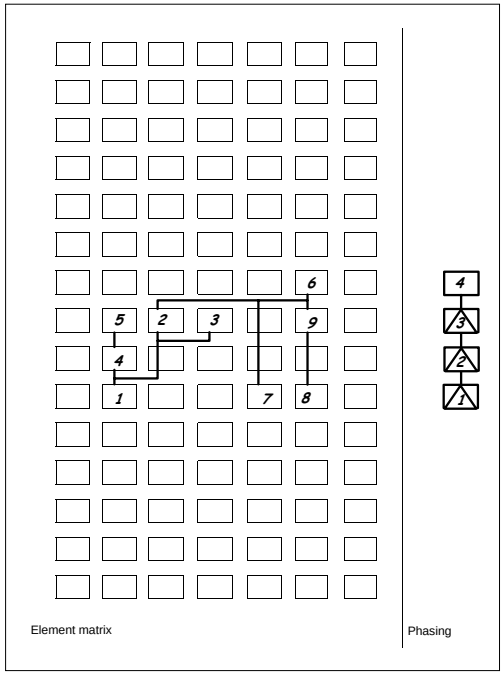
Structure *Commandants Res.* | **Area** *S8 and Roofing S7,8,10,11,12* | **Project #** *82/01* | **Sheet #** *001 (2 of 3)*

Element	Physical evidence	Historical evidence	Sequence	Date
3. Rafter ends and propos around S8 chimney [photo 276-9-12]	*No trimmers used as for S7 chimney. Rafters cut through and supported to allow introduction of chimney. Propos held with square-shaft nails.*		*Contemporary with S8 chimney.*	*C1844*
4. Roof framing S11/12 – rafters, battens, verandah beam [SEDS 0500, 0501, 0506]	*Rafters overlie shingles of S8 roof. Battens and beams cut through at N. end by S. wall of S5/6.*	*Documents mention un-specified additions in c.1843 (Brand Papers Vol. 2)*	*Post S8 roofing. Pre S5/6 S. wall.*	*c.1843*
5. South wall S5/6	*Battens and verandah beam of S11/12 cut through wall.*	*Documents mention additions approved 1844 (Brand Papers Vol.2)* *Plan by Hurst of 1846 (P.I. H1846/1) shows rooms.* *Sketch does not show rooms c.1842 (H.P.C. 2689)*	*Post S11/12*	*1844*

Port Arthur Historic Site Management Authority
Structural EVolution Data Sheet (SEV)

Structure *Commandants Res.* | **Area** *S8 and Roofing S7,8,10,11,12* | **Project #** *82/01* | **Sheet #** *001 (3 of 3)*

Element	Physical evidence	Historical evidence	Sequence	Date
6. Lath and plaster ceiling II [SEDS 0450]	*Circular-sawn laths held to circular-sawn battens. Spans across side of cross-wall and around chimney.*	*Circular-sawn timber may date to last decades of penal settlement [post 1858], but more-likely dates to post-convict period*	*Introduced after S8 cross-wall removed, and after S8 chimney was introduced.*	*Post convict*
7. lath and plaster ceiling I [photo 299-1-4]	*Nails and plaster traces on underside of joists. Covered by battens of lath and plaster ceiling II.*			*Convict-period c.1839*
8. S8 cross-wall [SEDS 0462]	*Wall plate remnant housed in wall plates of E. wall of S8.*		*Contemporary with wall-plates (and walls) of S8. Pre-dates lath and plaster ceiling II.*	*c.1839*
9. Sawn ends of wall-plates of S8 cross-wall {SEDS 0462]	*Wall plate (and cross-wall) removed, leaving traces of its existence on W. wall of S8 and remnant plate housed in E. wall of S8.*		*Post-dates cross-wall. Probably demolished when S8 chimney was constructed*	*c.1844*

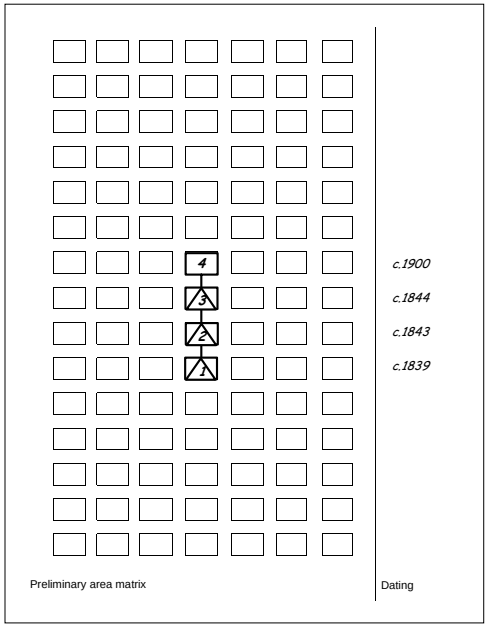


Structure Evolution Data Sheets, S7,8,10,11,12 Commandants House.
Obverse (above) and reverse (right)

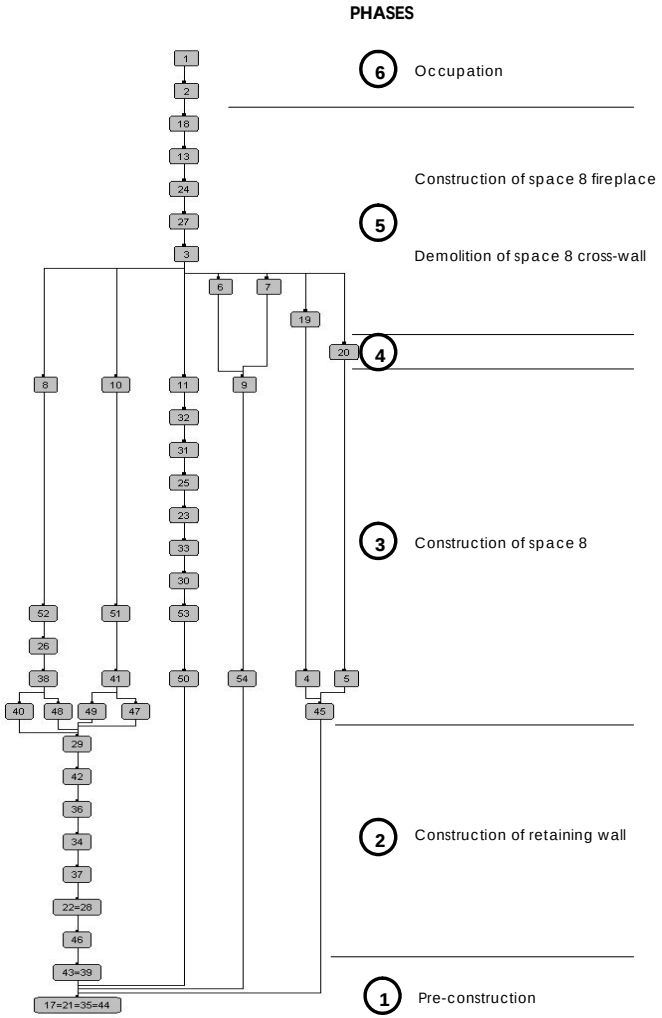
Port Arthur Historic Site Management Authority
Preliminary Structural EVolution Interpretation Sheet (PSEVI)

Structure: *Commandants Residence*	**Sheet #** *1*
Area: *S8 roof - jnc S11/12 & S6*	**Project #** *82/01*

Phase	Activity	Date
1	*Construction of S7,8,10 roof, lath and plaster ceiling I, and S8 cross-wall*	*c.1839*
2	*Construction of S11/12 roof*	*c. 1843*
3	*S5/6 constructed, S* cross-wall demolished, and s* chimney constructed*	*1844*
4	*Construction of second lath and plaster ceiling II*	*Post-convict c.1900?*



Preliminary Structure Evolution Interpretation sheet (PSEVI)

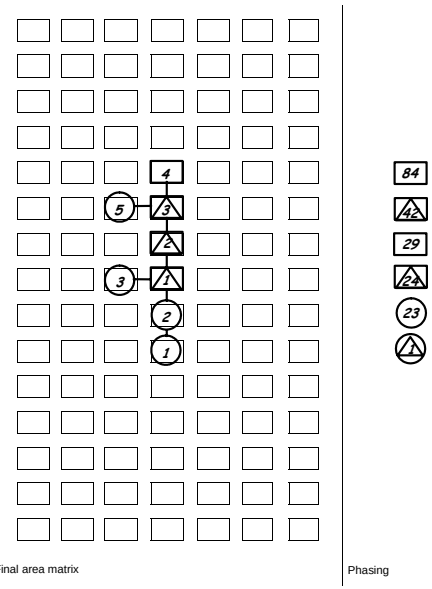


Excavation Matrix Commandants Residence, trench 56

Port Arthur Historic Site Management Authority
Final Structural EVolution Interpretation Sheet (FSEVI)

Structure: *Commandants Residence*	Sheet # *2*
Area: *S8 roof / Trench 56*	Project # *82/01*

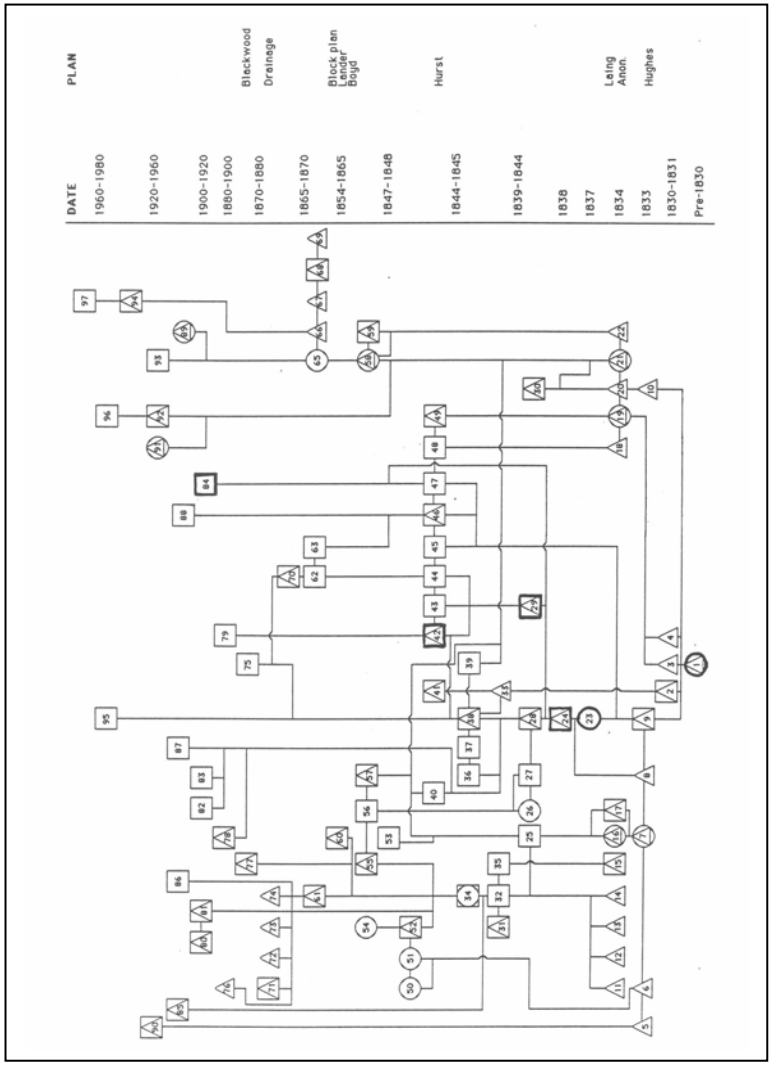
Phase	Activity	Date
1	*Pre construction*	*Pre-1830*
2	*Construction of retaining wall*	*c. 1837*
3	*Construction of S8*	*c. 1839*
2	*Construction of S11/12*	*c. 1840*
5, 3	*Construction of S6* *Construction of S8 chimney* *Demolition of S8 cross-wall*	*c. 1844*
4	*Replacement of S8 ceiling*	*Post-convict c.1900?*



Final area matrix

Phasing

Final Structure Evolution Interpretation sheet (FSEVI)



Final stratigraphic matrix for Commandants Residence (Davies 1987)