From infrastructure to icon: a historical and archaeological analysis of the Randell Dry Dock

by BRITT BURTON

On the banks of the Murray River in the small township of Mannum, South Australia, lies an impressive and rare feat of early colonial maritime infrastructure: the Randell Dry Dock. Originally constructed as a timber floating dock in 1873 by local entrepreneur A.H. Landseer, it was not suited to the long-term, and the limited water depth of Lake Alexandrina at the mouth of the Murray. Landseer sold the dock to Captain William Randell who towed it to Mannum to begin life as a dry dock. The imposing structure docked over half of all the paddle steamers on the Murray-Darling river system before superseded in 1927. Once the 'largest floating dock ever built in the southern hemisphere', it is now only one of a handful still existing internationally.

Archaeological investigations have been minimal on maritime infrastructure sites along the River Murray. A heritage river boat trail has been implemented by the South Australian Department of Environment and Natural Resources and the South Australian Tourism Commission. The Randell Dry Dock is part of this trail and on the State Heritage Register. With conservation becoming an issue, the Flinders University Archaeology Department collaborated with the Mannum Dock Museum to run two archaeological investigations on the site. The results have revealed new information about the dock's unique construction. Historical research and comparisons with other nineteenth century wooden floating docks has identified the Randell Dry Dock as an example of rare and historic riverine maritime infrastructure. This paper will outline the fascinating history and construction of this architectural gem, the seriousness of its current condition, and the on-going fight against the clock by archaeologists and the local community to protect this rare and significant example of South Australian Murray River history.

Keywords: maritime archaeology, dry dock, steamboats, Australia

In Australian maritime archaeology, there is a noticeable absence of data focusing on River Murray infrastructure and built heritage. The Murray-Darling Basin river system began to take shape over forty million years ago. Encompassing three-quarters of New South Wales, over half of Victoria, part of Queensland and the south-east corner of South Australia, it is approximately one-seventh of the entire Australian continent (Figure 1) (Bennett 2004:8). The Murray River combines environmental beauty, rich cultural heritage and is the world’s sixteenth longest river at 2530km (Griffiths and Jeffery n.d.). The dearth of riverine archaeology in South Australia can be linked to the hostile river environment. Strong currents, limited depths and low visibility make diving dangerous and surveying, as well as documentation, a time-consuming activity. It is because of these conditions that it is easy to imagine that many maritime archaeologists would probably prefer to work in the ocean rather than in rivers. As Attila Tóth from the National Office of Cultural Heritage in Budapest suggests, 'prospecting and photographing in the ‘Great Blue’ is much more spectacular than in the ‘Great Brown’ and easier to get sponsors for as well' (2006).

As Lake Mungo and other Aboriginal archaeological sites testify, the Murray-Darling Basin has at least forty thousand years of Aboriginal history (Baker 1992:1). While the coastal maritime infrastructure landscape has

Figure 1 Map of the Murray River Basin, Australia (Image courtesy Discover Murray River, 2012).
been studied intermittently, seldom have individual sites of riverine engineering and infrastructure been the focus of South Australian maritime archaeology.

Figure 2 Locality map, South Australia. The Randell Dry Dock is located approximately 85 KM east of Adelaide at Mannum on the banks of the Murray River (image courtesy H. & J. Griffiths, Jester Cruises, 2010).

The Randell Dry Dock in the small riverside town of Mannum, 80km northeast of Adelaide in South Australia (Figures 2 and 3), is an example of early colonial engineering and shipping at a time of growth and development on the River Murray.

A floating dock is a structure that can be submerged to permit the entry and docking of a vessel, which is then raised to lift the vessel from the water for repairs (Gaythwaite 2004:446). The first recorded examples of floating docks in the world came from the Baltic Sea and Great Britain in the eighteenth century. In order to repair his vessel, a Baltic Sea Captain removed the decks, bulkhead and stern of the hulk Camel. He floated the vessel into the larger hull then bulk-headed the stern before removing the water. The Camel floated high and dry with the smaller vessel inside accessible for repairs (Gaythwaite 2004:443).

The majority of docks are rectangular in shape, although some are shaped more like ships. Floating docks can range in size with modern lengths in excess of 300m and widths greater than 60m. Over time such docks have been constructed of wood, iron, steel and reinforced concrete. Timber is a natural construction material for saltwater vessels because of its durability (Gaythwaite 2004:445). Gradually, docks evolved into U-shape, rectangular and box shapes towards the latter half of the eighteenth century (Figure 4). Like the dock Landseer built, these were essentially timber hulls or shells, similar in shape to the ships they were intended to repair (Gaythwaite 2004:443). While most floating docks were constructed to be used in a particular location, one of their advantages, no doubt noted by

Figure 3 Looking east across the heritage listed Randell Dry Dock. The retired dock is the centrepiece of the Mannum Dock Museum (photograph by M. Fowler, courtesy Maritime Archaeology Program, Flinders University, 2010).

Figure 4 Common types of floating dock construction used around the world. The Randell Dry Dock is a ship-shaped or box shaped dock (image courtesy Gaythwaite, 2004).
Landseer, over dry docks was that they could be towed considerable distances, and hence the ability to establish repair facilities in locations where permanent docks could not be built.

A dry dock is simply an excavation or depression in the earth with one end open to the water. For dry-dockings, the seaward end was sealed off with a gate so the basin could be pumped dry (Gaythwaite 2004:409). Vessels entered at high tide and the gate closed. As the tide receded, the dock emptied itself through a tidal sluice, and the vessel settled on blocks on the floor. At locations with little or no tide, the water had to be pumped out of the basin. Masonry was often used for lining walls, and as docks increased in size, large pumps were added for rapid draining (Figure 5) (Gaythwaite 2004:410). A modern dry dock, when compared to its predecessors, differs significantly in terms of dimensions, materials, construction and sophistication of equipment; the basic principles of operation and design remain the same (Gaythwaite 2004:410). Advances in materials and methods of construction have continually expanded the dimensional limits of dry docks. Modern docks with dimensions over 400m in length and over 60m wide are used for the construction, maintenance, and repair of large ships, boats and other watercraft such as submarines.

Due to rising water levels in the Murray, the Mannum Dock Museum and the Save Our Dry Dock (SODD) group are under increased pressure to preserve the unique nineteenth century dock. The Randell Dry Dock project was first brought to the attention of the Flinders University Archaeology Department by the Museum, because of their concern regarding the long term conservation and management of the dock.

Timber floating docks were the forerunners of modern steel floating docks. By 1873, the time Randell’s dock was built, iron had become the predominant material for dock construction. This research into the dry dock is significant because few timber floating docks have survived into the modern era, and relatively little is known about their construction, let alone knowledge about those converted into dry docks. Over one hundred years and countless physical changes later, it appears that elements of the dock’s original floating construction remain. As a result, it has the potential to yield information about the construction and development of timber
floating and dry docks, which may be of value in a national and international context.

Historical Background

The pattern of settlement and development along the Murray River from the 1850s onwards was determined by distance from large trade centres (like Adelaide) overland and the methods of transport available. Transport by water was very cost effective, as roads and tracks were non-existent or barely formed and the slow progress of the bullock drays was subject to weather. Low freight costs and the availability of riverboats on the Murray River also provided the opportunity for farmers and entrepreneurs to open up access to huge areas inland (Swanbury Penglase 2002:9). However, it was the gold rush of 1851 in Victoria that encouraged the first river entrepreneurs to begin commercial navigation. The next ten years were to see the dramatic increase and evolution of the river trade (Swanbury Penglase 2002:9). The river trade had begun an expansion that would take it to between 200 and 300 boats operating on the Murray River system at its peak.

Albert Henry Landseer arrived in South Australia from England in 1848. As one of the successful diggers of the gold rush, he commenced work in 1858 as an agent for the River Murray Navigation Company at Port Elliot. Landseer worked hard to capitalise on the huge expansion in river trade during the 1860s and 1870s (Swanbury Penglase 2002:11). After relocating his headquarters to Milang at the mouth of the Murray River, Landseer became so successful he had branches in Goolwa, Port Victor, Murray Bridge, Morgan, Wentworth, Mildura, Menindee and Wilcannia (Swanbury Penglase 2002:11). Milang soon emerged as an alternative to Goolwa for the construction and refitting of river vessels as Landseer’s overland trade connections; there was less delay in obtaining materials and machinery than there had been at Goolwa. In 1873, Landseer commissioned the construction of a floating dock for use on Lake Alexandrina and as an alternative to the slip at Goolwa (Southern Argus, 1873).

Not suited to the shallow waters of Lake Alexandrina, Landseer put the dock up for sale and it was purchased in 1874 by flour miller and river boat captain William Richard Randell, a prominent river pioneer, for use as a converted dry dock at Mannum. Randell arrived at Mannum with the dock after a harrowing trip up the Murray. He reported that the dock ‘moved like a snake’ because it had no keel, making navigation extremely difficult. Randell capitalised on Mannum’s role as an important trading centre and a major port of export during the late 1860s and early 1870s (Swanbury Penglase 2002:16). Randell formed the River Murray Dry Dock Company to finance the adaptation of the dock once it got to Mannum. In order to install the almost 44m long structure, the river bank had to be excavated. It was eventually floated into place in February 1876 and officially opened on 5 June (Southern Argus, 1876). Problems began when the dock kept re-floating and began to leak. One hundred and thirty wooden pylons were driven through the dock and a traction engine was employed to keep it dry (Swanbury Penglase 2002:18). The dock went largely unused until major repairs occurred in 1880 and again in 1906. Over its forty-seven year commercial life, about half of the steamers on the Murray and Darling Rivers spent some time in the dock (Swanbury Penglase 2002:5). Its last commercial use was repairing the paddle steamer PS Marion in 1927 and it was officially closed with the introduction of a new slip upstream at Morgan (Swanbury Penglase 2002:5). The dock gradually silted up until the late 1980s when it was rediscovered and cleaned out by the local community with the aim of using it to dock and restore the PS Marion. After the restoration of the Marion, a pump kept it free of water so it could become the centrepiece of the Mannum Dock Museum (Swanbury Penglase 2002:29).
Significance of the Randell Dry Dock

The Randell Dry Dock was one of a few timber floating docks to have been constructed in Australia, and was the only dry dock on the inland river system. It is historically significant because the installation of the dock at Mannum greatly extended Randell’s ship building and repair facility. The dock attracted a large number of river vessels for repair and re-fitting, with up to thirty vessels using the dock per year (Swanbury Penglase 2002:14). The dock and its associated workshops consequently played a significant role in the employment of local shipwrights and tradesmen, and provided a thriving centre for maintaining the local ship building industry. The dock has a strong affiliation with a number of individuals who were extremely influential in the development of Murray River trade, like Landseer and Randell.

Randell was a pioneer navigator of the inland river system, having, through his own initiative, designed, built and sailed the first river steamer, the PS Mary Ann, in 1853 (Swanbury Penglase 2002:16). Based at Mannum, he had used the town for the construction and repairs of his own river vessels and had constructed a slip there in the 1860s. In 1874, he purchased Landseer’s floating dock and towed it to Mannum, where he supervised its installation into the river bank to form the current dry dock (Swanbury Penglase 2002:17). In association with his partners, Randell commissioned and supervised alterations to the dock in 1880. Despite leaving the town in 1876 Randell maintained his strong association with the river and Mannum, maintaining his fleet and the ownership of the dock until his death in 1911 (Swanbury Penglase 2002:24).

For fifty-one years, the dock was the focus of an important local industry. Besides providing employment it fostered a sense of pride and identity in the local community, making Mannum an important re-fitting port on the Murray River. The dock was and still remains an important element of the town’s identity. For example, in 1914 the local newspaper described the port area as the ‘dock end of the town’ (Mannum Mercury, 1914). Defunct by the late 1920s, the flooded dock was still used by the community for mooring small boats, and was referred to locally as the ‘old dock’. The use of the dock for the permanent mooring of the PS Marion in 1963 and its re-commission for the steamer’s restoration in the early 1990s returned the site to prominence in the mind of the community, with the vessel providing a visual identity for the site. This in turn contributed economically to the area with the opening of a successful museum and visitor information centre alongside the dock.

Methodology

Historical Research

A number of primary and secondary sources were accessed to learn about the dock’s original configuration. The unearthing of a set of engineering plans was a high priority for this research. Unfortunately there appears to be no surviving documentation relating to the inspiration or construction of the dock. The works of a number of overseas institutions and individuals were also sourced in the search for similar nineteenth century timber floating docks. This research was conducted not only to compare the Randell Dry Dock with other kinds of floating docks, but to be able to confirm or deny its singularity. In order to understand Randell’s dock better, it was comparatively analysed with other nineteenth century floating docks from Australia and other parts of the world (i.e., Chile, Peru, New Zealand and Bermuda).

Archaeology

Four archaeological investigations were carried out over a two year period beginning in 2009. Initial non-invasive investigations consisted of visual and ground penetrating radar (GPR) surveys as well as the creation of a full site plan. Two field seasons followed, which led to excavation on a number of areas in and around the Randell Dry Dock, photographic documentation, a second GPR survey and further site and feature drawings.

In an attempt to obtain the interest and support of the Mannum and wider Murray River community, a series of media statements were released to coincide with excavations in 2009 and 2010. Seven radio interviews were conducted to help boost public awareness about maritime archaeology and heritage protection in South Australia. This resulted in numerous visitors to the Museum who talked with team members about their memories of the dock and possible theories regarding its construction.
Site Plans and Technical Drawings

Aging interpretive signs produced in 1992 in coordination with the Mannum Dock Museum and DENR show detailed plans of the dock. Upon closer inspection of the drawings, what is physically visible in the dock remains is significantly different to its depiction on the signs. The baseline/offset technique was used in the production of all plans and drawings. This technique involves ‘measuring the location of features from an established baseline’ (Burke and Smith, 2004:96). This method is simple, versatile, and can be conducted with one or two people and requires basic field equipment. To begin, a suitable and level baseline must be chosen and ‘it must be aligned in such a way that most (if not all) of the features can be measured from it without having to lay another one’ (Burke and Smith, 2004:96). Once a compass reading has been taken along the baseline, offset measurements can be taken at a 90 degree angle. To complete an accurate floor plan of the site, the baseline was laid alongside the southern dock wall unhindered by debris and the in-built pump system (a prominent feature on the northern side).

Photography

A series of photographs of unusual features (trestles, iron rollers, etc), the gate, and both walls of the dock were taken on all site visits using a digital SLR camera. Photographs captured excavation activities and items of interest (e.g., areas affected by severe weathering). A photographic record was vital throughout this project not only to complement the historical documentation, but to record the dock’s deterioration.

Ground Penetrating Radar (GPR) Surveys

In June 2009, Dave Ross from Tron Civil Engineering in Adelaide volunteered his expertise and equipment to assist with the GPR survey. Initial searches were conducted along the southern side of the dock to identify any structural features still existing. A handheld GPR device was run over the base of the dock with the aim of determining the depth of the structure below the visible planking (Figure 6). In 2010, Ross returned to the site with the GPR and stronger detection software. The GPR was rerun over the southern embankment of the dock and detected a few interesting anomalies. Metal detectors and magnetic survey methods were considered for the site, but were not used due to the interference of utility pipes, trees, and an abundance of land fill disturbing the surrounding soil.

Excavation – Trenches and Test Pits

In 2009, due to Occupational Health, Safety and Welfare requirements, the excavation of the clay walls around the dock was initially restricted, during which time it was determined that the trenches were safe to enter and not likely to collapse (the clay was showing large surface cracks). The trenches were excavated in 0.10m spits which often varied due to the harsh digging conditions of the top soil and clay. Artefacts discovered during excavation were recorded and given a number associated with their relevant context. Dry sieving was undertaken with 5mm mesh for the top contexts before the clay became too condensed to be sifted. A plan view and stratigraphy drawing of each trench was completed after the excavation of the final context using an appropriate scale. Archaeologists returned to the site in September 2010 to discover the past nine months had seen a rise in river levels and as a result one of the main trenches was full of water. To solve this issue a pump was supplied by the local council to drain the area. The pump had to be employed continuously due to a strong leak in the clay.
A 360 degree excavator was brought in on the last day of excavation in September at the request of the Museum. This was to examine a GPR anomaly on the southern embankment and attempt to reach the base of the dock. The test pits were recorded and photographed, then refilled by the backhoe. After all excavations were completed, great care was taken to ensure minimal future damage to the dock and exposed areas. Hessian bags of clean sand were provided by the local council and were placed in all trenches before any excavated soil was returned to the site. Figure 7 (below) shows the positioning of all trenches from the 2009 and 2010 excavations.

![Figure 7 Areas of excavation during 2009 and 2010 field work. Time and weather restrictions prevented the expansion of Trench 1 during 2009 and it was reopened in 2010 (photograph by Burton, 2010).](image)

**Archaeological Investigations – Initial Assessment**

Previous archaeological work was undertaken at the site by DENR and the Flinders University Archaeology Society in December 1994 (Figure 8). The excavation was conducted in two areas: on the northern side of the dock and in an area adjacent to the dock on the southern side where timber storage and wood sheds stood. The site of the Randell Dry Dock was significantly different during the 1990s. Before the Mannum Dock Museum and visitor information centre was built, the site had been home to a number of historic sheds, a mechanic’s garage, and a car park. Several trenches revealed over 200 artefacts, which could not be directly related to the dock due to the amount of soil disturbance within the area (Piddock 1995).

Initial site assessments of the dock in June and October 2009 by archaeologists from Flinders University found no indication that the immense structure was constructed in the typical way of a floating or dry dock. It appeared that neither aesthetics nor conventional construction methods were considered as part of its design process. While assessing the dock a basic floor plan, measurements and GPS location were recorded.

A number of anomalies were also discovered during the initial drawing and assessment of the dock:

- It is evident that many of the trestles have undergone repairs with different types of wood added for extra support;
- A variety of types and lengths of bolts were used;
- The DENR plan suggests that some of the trestles and rollers are missing from the site; and
- A small copper alloy drain (115mm diameter) was discovered off centre on the south-western side of the dock, whose function has not yet been determined (Figure 9).

Figure 8 1994 archaeological excavations underway on the southern side of the dock by staff and students from the Flinders University Archaeology Department. In the background the PS Marion is docked at the Museum’s wharf (photograph courtesy Piddock, 2010).

Figure 9 This copper alloy drain (11.5cm in diameter) sits in the far south-west corner of the Randell dry dock. Despite further investigation during the September 2010 excavations, its function is still unconfirmed (photograph by Burton, 2010).

What was initially thought to be a circular floor drain in the centre of the dock was emptied of water to reveal a corroded iron bucket with what appeared to be a three-pronged screw handle in the bottom. Tentatively identified as a sump cap, it would have been used to help monitor and drain water from the dock while it was in use. The area was then refilled with water in order to preserve the remains.

Archaeological Investigations – December 2009

The first excavations for this project took place in December 2009 and yielded some of the dock’s structural secrets.

Trench 1 – Northern Side of the Dock

The largest trench was opened on the northern side of the dock. This trench focused on excavating to the base of the dock (around 2m down) to assess the condition of the timbers and identify any original floating dock features. Trench 1 revealed the beginning of prominent structural features including a walkway and retaining wall (visible in the historic photograph in Figure 10 and the walkway from the 2009 excavation in Figure 11). A large horizontal pile, 0.50m in diameter, was also discovered and appeared to support parts of the walkway. The results from Trench 1 were useful but not conclusive enough to confirm the presence of any floatation apparatus. If a sealed floatation chamber was discovered, timber on the outside of the dock should seal a cavity down to the base. No such timber was found and the vertical timbers appeared to end approximately 2.5m above where the base of the dock should lie.

Trench 2 – Dock’s Pump

The excavation of the pump area was undertaken to determine the original fittings, however, this was challenging due to water level rises during and after the removal of excess water and mud. The base of the pump was hit at 0.30m revealing an open wooden box structure. In the box there appeared to be deposits of gravelly concrete, similar to that above the pump area. This may have been due to accidental spillage or to stop leaks. Above the pump is a wooden opening and tunnel that heads north underneath the dock draining into the river. A 2m range pole was pushed into this opening, but did not hit the end of the tunnel. It is assumed that it is likely to be part of the original construction and continues out underneath the dock and surrounding bank. There were very few artefacts found in the pump area. A few bolts were found in the lower spits and natural debris discovered throughout.
Figure 10 PS Cumberoona in the dock at Mannum circa 1885. This historical photograph clearly shows a walkway and retaining wall on the northern side (left) of the dock (photograph courtesy Mannum Local History Collection No.288, 2006).

Trench 3 – Underneath the Dock’s Floor Planks

Excavation also commenced underneath three of the newer floor planks, which revealed three large vertical pylons which may have been used to help stop the dock from floating (Figure 12 & 13). In between the pylons were a series of flush planks, still in very good condition due to their muddy and wet environment. They are assumed to be the final layer of planking or the ‘base’ of the dock. There were issues with recording and photography as water from the river quickly refilled the sections that were emptied. A range of depths were recorded throughout the trench. From the base planks to the top of the ceiling planks, depths ranged from 0.28m to 0.31m. A handful of artefacts were removed from this trench, mainly a number of corroded metal bolts, washers and screws. Pieces of limestone, shale, glass, charcoal and a fishing sinker were discovered throughout the trench.

Figure 11 Looking East along the uncovered walkway in Trench 1. This was the full extent of the structure uncovered during the December 2009 excavations (photograph by Burton 2009).

Figure 12 The Randell Dry Dock Pump after excavation in December 2009. This area is still used for draining the Dock of water by means of a modern pumping system maintained by the Museum and local Council (photograph by Burton, 2009).

Figure 13 Well-preserved structural elements and vertical timber piles were revealed underneath the ceiling planking of Trench 3 (photograph by Burton, 2009).
Archaeological Investigations – September, 2010

In September 2010, a team of archaeologists returned to the site to continue work with the aim of revealing a section of the outer structure of the northern side of the dock. The team members assisted the volunteers of the Mannum Dock Museum with archival tasks over seven days and uncovered a number of photographs documenting the restoration and launching of the PS Marion. This was a significant find as the photographs revealed the previous terrain surrounding the area and the condition of the dock during the late 1980s. The project also combined surveys and the excavation of two trenches and two test pits in order to expose and document the structure underneath the dock. Trench 1 from the previous year was reopened and continued despite rising water levels hindering progress. In order to fully understand the conservation issues surrounding the dock, the Museum required the buried structure and base of the dock to be uncovered, which allowed conservationists to assess the remaining timbers.

Trench 1 - 2010

Upon initial inspection of the trench, it appeared as though excavation would not commence as the area was full of river water. A council pump was able to free the culvert of water temporarily, but a crack in the southern clay wall revealed the source of the refill. As the water drained, it was obvious that the clay wall was corroding badly, much more so than in December. It was decided that a photographic record would be taken as well as excavating a small test area in the southeast and southwest corners of the clay wall.

Further exploration in the culvert revealed a second horizontal pile, similar to the one discovered during the December excavations. After revealing as much of the pile as possible its dimensions were recorded. With a diameter of 0.47m, it was determined that it was connected to the second pile found previously. Excavation revealed four separate wooden planks resting on top of the pile. These timbers were not attached to the pile, but from their positioning had obviously been deliberately placed. Excavation towards the top of the trench revealed no further structural timbers. It appeared as though the walkway timbers were not attached to the pile, and had nothing else underneath them for support except the clay itself. Work began underneath the pile, revealing two more planks of wood. From their accidental positioning they were deduced to be landfill material rather than structural support.

To confirm or deny the presence of another horizontal pile, the top of Trench 1 extended south towards the dock wall. While there was enough room between the first pile and the edge of the outer wall to fit another between them, no pile was discovered. The work on the outer wall of the dock revealed 1.5 planks of a substantial size. While obviously dried out and deteriorated, the flushness of the planks indicated that at one time they would have been watertight. At the end of the excavation, the absence of any floatation chambers and the presence of the horizontal pile required the assumptions about remaining floating dock structure to be reviewed.

Trench 4 – Southern Side of Dock 2010

The results of the GPR surveys discussed above, led to a reasonable assumption that there was no prominent floating dock structure remaining on the southern side of the dock. Therefore, an excavator was hired to dig a large trench on the southern embankment of the dock. This was placed as close to the western end as possible so as not to risk the safety of visitors to the museum or hinder viewing of the dock. Excavation ceased when the digger reached two timber planks at 1.12m. These were horizontal planks running parallel in a north-south orientation, but confusingly did not sit flush with the edge of the outer wall of the dock. The planks were at least a length of 1.50m, but the full length could not be determined as they ran into the southern embankment. The floor of the trench was levelled to the height of the two planks and was excavated to the east to see if the pattern continued, but no trace was found.

A cross-section (1m by 0.80m) was excavated to reveal the structure of the dock’s outer wall (Figure 14). A thin horizontal pile was discovered close to the base of the trench running in between the large vertical pile on the western end and the outer skin of the dock. This was not substantial enough to be considered as a structural support pile. In front of the horizontal pile sat another piece of planking. The western end of the plank had been cut specifically to compensate for the vertical pile on its left hand side. This plank (lying diagonally along the cross-section) was cut flush at the eastern end and not connected to anything. The deliberate alteration indicates it was placed to serve a particular purpose.
A number of artefacts were uncovered upon opening Trench 4. The majority were considered landfill items from the PS Marion restoration. Two items, a small clear glass bottle dated to the early 1900s and a graphite cylinder possibly from an old battery, were photographed before being replaced in the trench. A number of rusty iron fire bars from paddle steamer boilers were removed from the excavation site and given to the museum.

Test Pit 1 and 2 – 2010

A large GPR device was run over the southern embankment of the dock. The first set of scans taken in October 2009 aimed to locate a structure on the southern side but revealed no significant anomalies. In 2010, the GPR software used was more powerful but the scans were difficult to interpret due to the poor quality of the soil. Anomalies were found at 1m, 11m, and 13m and were investigated using two test pits dug by the excavator. Test pits 1 and 2 contained similar planking to that of Trench 4, but at a shallower depth of 0.70m. Test Pit 1 contained two planks, which ran from the outer dock wall south into the embankment. The wood was in poor condition, appearing very damp and spongy as the result of fluctuating river levels. Three timber planks were identified in Test Pit 2 at a depth of 0.62m (Figure 15). They also had a north-south orientation and the timbers visible in Test Pit 2 were also damp, spongy and badly corroded. There appeared to be some sort of black stain on all of the planks. This could have been caused by the dark clay staining the wood or perhaps was evidence of tarring.

Discussion

What remains of the original floating dock structure?

It cannot be said with absolute certainty that there is nothing left of the dock’s floatation apparatus. Not reaching the base of the dock during the two excavations means that the remains of a chamber somewhere at the base cannot be discounted. However, it can be deduced that two things do survive from the floating dock era: the vertical outer walls and the double floor. During excavation in Trench 1 and Trench 4, it was found that the vertical walls had a black substance on the outside. This appears to be evidence of tarring, which would have been used to keep the dock waterproof. Work in Trench 1 determined that towards the base of the dock, the walls must still be waterproof as water was leaking into
the culvert and not out into the dock. It would have been far too expensive for Randell to replace the floor planking continually. A ceiling on top of the original structure was a quicker and easier option, and more profitable.

The other structure of possible original construction was the walkway running the length of the northern side. Historical research has found that some wooden floating docks had overhanging side walkways, such as the floating dock Alpha in New Zealand. This would allow workmen to move about the dock freely and allow another vessel to berth alongside (Port Chalmers Maritime Museum pers. comm.).

**Figure 16** The US Brig Emma docked in Alpha. In this photograph the walkway that extends out from the dock is clearly visible on the left hand side (photograph courtesy Port Chalmers Maritime Museum, 2010).

The results of Trench 1 suggest that the walkway appears similar in design to that attached to Alpha in New Zealand. Randell’s dock has three layers of planking attached to 0.67m vertical support beams. However, unlike Alpha, there are no diagonal support beams underneath the walkway to ensure its stability. A more likely scenario is that the walkway was constructed at Mannum. While an attached walkway was a possibility for a floating dock and could have been potentially detached, modified and reattached later, it is much more plausible that this is a later addition to the site. There are historical photographs showing the walkway on the northern side along with a retaining wall (e.g., Figure 16). The vertical piles appear to be the supports for this retaining wall. The walkway was probably constructed elsewhere and moved into place on top of the surrounding clay. It may have been part of another wharf structure that was conveniently lying unused at the time. An additional and unlikely possibility was that it was purpose built. If so, it was an exuberant piece of construction. With three layers of planking at 20m long, it would have been quite heavy and therefore have been a nightmare to manoeuvre. What is puzzling about this walkway is that it does not appear to be attached permanently or solidly to the dock. This suggests it may have been a temporary structure that eventually became permanent.

**Figure 17** This diagram drawn after image taken during the September 2010 excavations. It is a profile view of Trench 1 (looking west) providing an example of what structure still remains underneath the northern bank and walkway of the Randell Dry Dock.

The large horizontal piles in Trench 1 were unexpected (Figure 17). With their size and placement, it appears as if they may have been used for structural support when the dock was inserted into the bank at Mannum. Due to the difficulty of manoeuvring the floating dock, Randell would have excavated an area slightly bigger than the structure in order to ensure the insertion process ran smoothly. It is then possible that the large piles were rolled into place on the northern side pushing the dock hard up against the southern side to stop it moving. However, the piles are not lying flush alongside the outer walls of the dock. There appears to be enough room between the piles and the outer wall to easily fit another in between. The structural support theory does not explain the four square planks found deliberately set on top of the pile. These planks are a strange addition to this area. There is evidence of an indent cut into the pile for one of the planks, but what was their purpose? Are there planks missing, or was there another plank placed on top of the others? Once again, it is peculiar that the planks are neither nailed nor bolted into the pile considering there was
no shortage of either. Nothing is resting on top of the planks so it can be assumed they were not a support structure like the pile, and they are too deep to be considered part of the walkway. It is possible that there is structure missing, or that this may be an isolated incident, a speculation that cannot be ruled out.

Is there evidence of the dock’s floating apparatus?

While it has been acknowledged above that little evidence of the dock’s floatation chambers survive, it does not confirm or disallow the possibility of such structures during its time as a floating dock. A floating dock, by definition, needs to have pontoons to help it float and they need to be substantial enough to support whatever vessel it is carrying at the time. Due to the minimal tidal movement on Lake Alexandrina, the dock probably would have had watertight chambers on the sides and underneath the floor. The dock has a double floor with 0.20m of space between the two layers of planking and cavities along each side created by the sloping walls. However, these are not sufficient enough to float a dock reputed to weigh 350 tonnes as well as accommodate any vessels.

While there have been no written sources found by the author detailing the method used to raise and lower the Randell Dry Dock, other research suggests that side floatation chambers were common (Swanbury Penglase 2002:39). Excavation results have found no trace of any such chambers on either side. As mentioned previously, it cannot be ruled out that there is nothing remaining of these chambers. The vertical support beams may represent the outer wall of the floatation chambers. However, the timbers have been sawn horizontally implying someone had to cut a vertical timber above their head, which is extremely unlikely. Until the base of the dock has been revealed, it cannot be discounted that part of the floating apparatus may still survive.

What structural features were modified during the conversion process?

After Randell purchased the dock from Landseer, he made certain modifications to convert it into a dry dock. The dock’s floatation chambers caused trouble for Randell and therefore their absence on site may be explained this way. It is unknown if the dock had a gate at the beginning of its life, but the current gate is assumed to have been added at Mannum. The function of the planking found at the base of Trench 4 and in the two test pits is unknown. They sit roughly at the same depth as the horizontal piles in Trench 1 and similarly are not flush up against the outer wall of the dock. With the planks three times as wide as they are thick, they are not physically strong enough to be sufficient braces. There are vertical piles supporting the southern side of the dock and the planks are too deep to be part of a walkway structure. A date for these planks is also uncertain, it is not known if they are original or a later addition.

Conservation Issues

While the Mannum Dock Museum and local community maintained the dock in accordance with the original conservation plan, it became apparent from the dock’s rapid deterioration that the original conclusions needed to be reviewed. After it was closed commercially, the dock was kept filled with water so that the bulk of it was generally below river level and in stable anaerobic conditions. After the dock was cleaned out, the timber of the inner lining was virtually crack free, smooth and quite level: safe to kneel, sit, and lay on while restoring the PS Marion. Today the wood of the dock is badly desiccated and undulating with very obvious corrosion. Less obvious but more worrying, is the biological deterioration (i.e., rotting) in the cells of the structure. Deterioration is occurring at a much faster rate than envisaged due to fluctuating river levels. The widespread clearance of native vegetation for agriculture and irrigation has led to an increase in the infiltration of rainfall to the groundwater. This has raised the local and regional groundwater table greatly increasing salinity in the river systems (Harris 1992:2). Over the past few years the river has fallen about 1.8m, even though Mannum is 150km from the Murray mouth (Swanbury Penglase 2006:6). It has recently begun to rise again and once more the dock is completely submerged. Fluctuating river levels are a constant danger to the dock, as they create cycles that increase deterioration and change the surrounding soil from an anaerobic to aerobic environment.

Conservator Christopher Payne from Art Lab Conservation in Adelaide voluntarily gave his time regularly throughout the project to assist the Mannum Dock Museum and the author with an analysis of the condition of the dock’s timbers. Payne (pers.comm.) identified the four principal modes of deterioration as follows:
- Increased rates of weathering

Previously with higher water levels, water evaporating from the surface was being replaced by more water drawn up through the wood. When the underside of the floor was not in contact with water, the topside was drying out badly with deepening cell collapse, showing as deep splitting in the wood.

- Increased rate of rotting of underside timber

This is due to a change from anaerobic to aerobic conditions in the soil under and around the dock as the water level falls. This provides optimum levels of moisture and air for biological activity, encouraging rotting.

- Increase in soil acidity

An increase in acid sulphate has been reported at many river sites with unstable river levels which rapidly increases weakness in the structure.

- Increase rate in floor movement

This is due to uneven drying out of soil beneath the dock. Some parts of the dock appear to be still secured to the piles, but others are not. This gives rise to the undulating effect in the floor. Observed over the past two years, this movement is creating greater strains on the structure especially where timber is already damaged by corroding iron fastenings.

**Future Conservation and Management**

With the current rate of deterioration, there is an urgent need to support and stabilise the dock’s timbers and sufficiently manage the site. The dock is associated with a significant phase of river transport, from 1873 to 1927. Its original use as a convenient place of repair and refitting of river vessels was superseded by the slip at Morgan, which was considered to be more suitable for the repair of contemporary river vessels. The limited use of the dock for the repair or restoration of historic river vessels would be an appropriate interpretation method to present the significance of the dock, although this is also likely to limit the opportunities for greater public access to the dock area. It is unlikely that the dock can be used for continuous vessel maintenance without the need for a major upgrade. The dock is no longer watertight and it is doubtful that it can be made so without significant alteration of the fabric. As the dock has been listed on the South Australian Heritage Register, certain restrictions apply to the site as set down in the South Australian Government’s 1993 *Heritage Places Act*. It has been necessary to maintain a levee bank to keep water from the dock, so the coming and going of vessels is not practical given the requirement to remove and replace the levee. It is therefore likely that the dock will only be used occasionally with an emphasis on interpretation rather than commercial operation.

The dock had been repaired and overhauled several times during its working life, with the likelihood that portions of the timber were replaced from 1873 to 1927. From the 1980s onwards, there has been replacement of timbers in certain areas in order to maintain the structure using red gum so the repairs are as close to indistinguishable from the original planks as possible.

Conservators have reassessed the dock and the outlook is bleak. There is a window of less than ten years in which to take major preservative action. The SODD group at Mannum has researched options to slow down the increasing rate of deterioration. These have included treating the dock *in situ* with boron based wood preservative chemicals or keeping the dock filled with water and introducing biocides to keep it clear and therefore visible to museum visitors. Unfortunately, both of these solutions would cause chemical leakage into the Murray River, and therefore contamination to flora, fauna and a widely used water supply. A more expensive (in the region of millions of dollars) and therefore much more unlikely option would be to excavate it entirely, lift it from the area and put it undercover where it can be preserved without risk to the environment. While the significance of the dock can justify the expense, it will ultimately remove it from its historical context. In the short term, the construction of a roof to protect the dock is being considered. With a goal to see the dock on the National Heritage Register and public awareness increased about this rare feat of engineering, it is important that a solution is found and implemented to ensure the longevity of this site. One hundred and thirty seven years on, it is amazing that this incredible example of colonial maritime engineering still survives. With relatively little
known about wooden floating docks from the nineteenth century, the Randell Dry Dock holds vital information about the river trade industry; it is a significant historical landmark for Mannum and is evidence of South Australia’s colonial adaptation to the Murray River.

Acknowledgements

I would like to thank the following people and institutions for all their help on this project: Associate Professor Mark Staniforth; the staff and volunteers at the Mannum Dock Museum; the Flinders University Archaeology Department; the South Australian Department of Environment and Natural Resources; and all the conservators, architects, curators and fellow maritime archaeologists across the world who gave their time to assist me with my research.

Bibliography


Mannum Mercury. (1914). No Title. 25th September. N.P.

Perth Gazette and West Australian Times. (1866). No Title. 4th May. N.P.


Southern Argus. (1873). Milang, 22nd August. 22nd August. N.P.


Southern Argus. (1876). Milang, 17th February. 17th February. N.P.

