BATHERS WAY SHORTLAND ESPLANADE

Results of Archaeological Monitoring

FINAL

March 2016
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on behalf of
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1.0 Introduction

The Bathers Way connects Newcastle's five main beaches from Merewether Ocean Baths to Nobbys Beach. The Bathers Way is being upgraded to provide comfortable pedestrian and cycle access for diverse recreational uses; including wider shared pathways, shade, seating and viewing areas.

The Shortland Esplanade section of the Bathers Way is located between Nobbys Beach and Zaara Street and is partially located within the State Heritage Register (SHR) listed Coal River Precinct (listing number 01674) identified as comprising 32, 40, 51, 72B, 74, 76, 78 and 80 Nobbys Road, Newcastle East, NSW 2300 (refer to Figures 1.1 and 1.2).

An exemption from the need for a Section 60 approval, in accordance with Section 57(2) of the Heritage Act 1977, was endorsed by the Heritage Division, Office of Environment and Heritage (OEH) on 12 September 2014 for the construction of the Shortland Esplanade section of the Bathers Way and minor impacts to a section of the former Nobbys Head Railway located within the SHR listed Coal River Precinct.

The construction of the Nobbys Beach portion of the Shortland Esplanade section of the Bathers Way and associated landscaping works are now complete. This report has been prepared as a record of the archaeological monitoring works undertaken during the construction of the new Nobbys Beach car park and associated pedestrian pathway (the Project area) (refer to Figure 1.3). All archaeological monitoring was undertaken in accordance with the Archaeological Work Method Statement prepared as part of the Bathers Way Shortland Esplanade, Newcastle Exemption Application (Umwelt 2014).
Legend

Shortland Esplanade Section of the Bathers Way

FIGURE 1.1
Locality Plan
2.0 Historical Background

This historical background has been prepared utilising research material and information regarding the history of the Southern Breakwater and its rail line provided by Larry Greentree (Australian Railway Historical Society Newcastle).

2.1 Exploration (1770 – 1804)

Captain James Cook sailed past Stockton Bight in 1770, noting only Nobby’s Island and Port Stephens. The first knowledge of the Newcastle and broader Hunter region came in 1791 through tales told by escaped convicts. In 1797 Lieutenant John Shortland entered the Hunter River estuary and came ashore along Stockton Bight during a search for escaped convicts. He discovered the coal resources responsible for much of the later European settlement in the wider Hunter area.

Governor Philip King sent an expedition in HMS Lady Nelson, which arrived off the mouth of the Hunter River on 14 June 1801, to make a more systematic exploration of the Newcastle area. As a result Governor King decided to establish a permanent settlement there; however the venture failed within six months and the convicts and their overseers were evacuated back to Sydney (Turner 1997:7).

2.2 Penal Settlement (1804 to 1822)

2.2.1 Settlement

It was not until 1804 that Newcastle was resettled as a penal colony with Watt Street, to the west of the Bathers Way, forming the settlement’s main street.

The penal settlement was founded under the administration of Lieutenant Charles Menzies with 34 Irish prisoners, exiled by Governor King for their role in the Battle of Vinegar Hill of 1804. The expedition to found the new settlement left Sydney on 28 March 1804. Menzies named the new settlement Kingstown, but Governor King’s own choice, Newcastle, prevailed. At its peak in 1821 the population of the penal settlement was more than 1100.

The penal settlement was closed in 1823 in favour of a penal colony at Port Macquarie (Turner 1997:14).

2.2.2 Macquarie’s Pier

Macquarie’s Pier was constructed to link Nobby’s Island to the mainland. The pier was conceived by Captain James Wallis, the then Commandant of Newcastle, and its construction agreed upon by Governor Lachlan Macquarie in 1818. Surveyor James Meehan drew up the plans showing the lines of the intended pier and its construction commenced in 1818 (refer to Plate 2.1). A quarry was opened in the area of present Fort Scratchley to provide stone for the pier and other construction projects. By 1822 it was reported that approximately 625 yards of the proposed 930 yard pier had been completed (Turner 1994:2-5). However, when Newcastle ceased to be a penal settlement in 1823 works on the pier discontinued.
2.2.3 Signal Hill

What is now the Fort Scratchley site was the location of the first coal resources identified and mined in Newcastle. The strategic importance of the hilltop site overlooking the harbour was also recognised with navigational beacons being established in 1813 and a signal mast installed 1816.

2.3 Newcastle’s Government Town (1823 to 1853)

With the closure of Newcastle’s penal settlement assistant surveyor Henry Dangar established the Newcastle town plan, the core of which makes up the current Newcastle central business district. Dangar imposed a regular grid plan on the more disorganised penal settlement. In laying out the town plan the intention was to prepare the town for its role as a port to service the rapidly developing Hunter Valley (Turner 1997:12).

2.3.1 Macquarie Pier / Southern Breakwater

Without the convict workforce to work on the pier, its construction did not continue until 1833. With the development of the Hunter Valley, the increased importance of a port at Newcastle and pressure from settlers the Government decided to allocate funds to the construction of the pier/breakwater; which resumed in 1833 with the majority of the small number of convicts remaining in Newcastle employed on its construction. The top of Nobby’s Island was quarried from 1836 to obtain more stone and begin construction from the Nobby’s Island end of the pier/breakwater. The pier/breakwater was completed in 1846 with maintenance of the new breakwater continuing into the 1850s (Turner 1994:5-6).
2.4 Development and Expansion (1853 - 1900s)

2.4.1 The AA Company

The population of Newcastle remained very low until the 1850s, with the commercial and industrial development of the area hampered by inefficient land transport (Suters 1997:2/2) and the AA Company’s monopoly over land and the coal industry.

The A.A. Co had been chartered by the British Parliament in 1824 and established itself in Newcastle soon after. The company was granted 2000 acres on the western edge of the Newcastle settlement for the development of their coal mining operations, which they had taken over from the colonial government after the closure of the Newcastle penal station. In 1831 they sank their first shaft, mining coal with the intention of exporting it to India to supply the steam ships of the East India Company. The company operated ten collieries within the Newcastle area, located between Darby Street and Hamilton, through the nineteenth and into the twentieth century.

The A.A. Co was guaranteed a monopoly on the mining operations and their land in Newcastle was therefore left undeveloped from any commercial or residential use, effectively defining the western boundary of Newcastle. However with the lifting of the monopoly in 1847, some of the A.A. Co’s surplus land was made available for subdivision for development. The first subdivision in the early 1850s included the extension of Hunter Street, then known as Blane Street and named after the deputy governor of the A.A. Co. New coal mines and their associated villages also began to appear. The mines began to ship their coal through the Port of Newcastle, contributing to its development and fostering commerce in Newcastle itself.

2.4.2 Great Northern Railway

The construction of the Great Northern Railway began in 1854. The first stage between Honeysuckle Point Station at Newcastle and East Maitland was opened by Governor Sir William Denison on 30 March 1857. The railway gradually extended through the Hunter Valley and into Northern NSW, reaching Tamworth 25 years later. Newcastle could now serve as the port of a rapidly expanding region with the development of the railway system bringing coal and agricultural produce from the Hunter Valley.

Private railways facilitated the transport of coal to Newcastle and within a decade mines had opened at Minmi, Wallsend, Lambton and Waratah (Turner 1997:27). Over the middle decades of the nineteenth century greater Newcastle developed as a series of outlying colliery and manufacturing villages encircling the town centre, which essentially functioned as the port for the export of coal.

2.4.3 The Southern Breakwater and Nobbys Head Railway

In 1866 it was decided to reconstruct Newcastle’s Southern Breakwater (former Macquarie’s Pier) using stone from a quarry in Waratah. An embankment was built from the Great North Railway so the stone could be brought by rail to the edge of the breakwater. Nobbys Head Railway comprised the extension to the Great North Railway along the breakwater out to Nobbys Head. Nobbys Head railway was utilised from approximately 1869 to transport ballast and large stones that had been brought by rail from the Waratah Coal Company quarry to assist the construction and strengthening of the breakwater to Nobbys Head and then out to Big Ben Reef (Turner 1994:6-7). The railway was unique as although breakwaters commonly had rail along them, the Southern Breakwater and its rail line were connected directly into the main rail system of the Great Northern Railway (L. Greentree pers. comm. 9 March 2016).
A 1920s map showing the Railways of the Newcastle District indicates the quarry at Waratah and a quarry branch line off the Wallsend Railway (refer to Plate 2.2).

An article published in the Maitland Mercury and Hunter River General Advertiser on 8 June 1869 describes in detail the various harbour works being undertaken at Newcastle at the time; including repairs and extensions to the Southern Breakwater and the construction of a ‘tramway’ from the Queen’s Wharf sidings to the breakwater. This ‘tramway’ became Nobbys Head Railway:

**Some important repairs are now being effected to the Southern Breakwater, which extends from the Old Signal Hill to Nobby’s-a length of about 2000 feet. This breakwater appears to have been constructed originally of a soft description of stone, obtained from the foot of the Old Signal Hill, being thrown upon a sandbank that extended across toward Nobby’s. Where now there exists a wall of stones, having an average width at the base of 100 feet, ships drawing 15 feet of water have been known to sail through into the port. The waves of the Pacific dash with terrific force upon the breakwater, during the prevalence of the south-east gales, and in the memorable storm of 1866, in which the ill-fated Cawarra foundered, a large gap was made in the middle of the wall, the stones having been washed out almost to the foundations by the powerful action of the sea. The stone originally used in the formation of the breakwater was then found to have perished by the action of the air and water.**

**Works are now being carried out not only to repair the breach, but at the same time to strengthen and consolidate the whole length of the wall. For this purpose a line of tramway has been laid from the sidings at the back of Queen’s Wharf and the life-boat sheds, passing which it turns on to the breakwater. By this means locomotives can haul the heaviest loads of stone on to the breakwater to the spot where they are required. The tip wagons are so constructed as to allow the stone to be shot out either into the breach forward, or thrown off at the sides of the breakwater. The stones which are now being used are in blocks of enormous size, and average from six to twelve tons in weight. They are slung out by an ordinary crab winch, which, placed on a truck laid to a 3 feet 6 inch gauge, moves from one side of the breakwater to the other as required. The crab winch...are placed on a strongly-built gantry, resting on rocks of rubble masonry in the**
base of the breakwater. The harbour side of the breakwater, so far as it has been repaired, is being faced with hand-pitched stone, built in and bonded on a natural slope, which gives a finished appearance to the work. The immense blocks of stone thrown on the sea side of the breakwater gradually settle down in the sand, and it is expected that the foundations which are now being laid and widened, will form the base of a structure which will offer a permanent and complete barrier to the assaults of the sea.

The quarry from whence the stone is procured for repairing the Southern Breakwater is situated between Waratah and Wallsend, about four miles from Newcastle by rail, and alongside the new coal tunnel being opened by the Waratah Coal Company—a short siding off that company’s line leading to the face of the quarry. The stone is a blue sandstone, belonging to the coal measures, and is found to be excessively hard, especially the lower beds. Although the quarry has only lately been opened, the stone appears to be turning out ‘very well’. The lower bed is now seven feet thick, and it is thought will be twelve feet thick a few feet further in. Stones of eight and ten tons are easily procured, and sent to the breakwater daily. The working face at present is about twenty feet deep, but when the work advances about forty feet. The stones are lifted by two pairs of sheer legs forty feet high, one pair being placed over each line of rails, and spread wide enough to allow the track to pass under when the stone is up. The hoisting is being performed by two steam winches, placed a short distance away. The winches were made at Cockatoo Works, and appear to be well adapted for the work. As there is very little clay over-lying the rock, the outlay for stripping will be very trifling, and the area over which the stone can be quarried appears very large (Maitland Mercury 8 June 1869).

The Maitland Mercury article also discusses the construction of the Northern Breakwater using Melbourne blue stone, which was brought to Newcastle as ships’ ballast. The Northern Breakwater was constructed to divert the course of the current, so as to form a scour to deepen the mouth of the harbour and to wash away the sand bank known as the North Spit. Following the Northern Breakwater construction there was ‘fifteen feet of water’ where, prior to the beginning of the work, the sandbank was evident above the water (Maitland Mercury 8 June 1869).

As reported in the 1869 Maitland Mercury article, Nobbys Railway would have originally been narrow gauge (3 feet 6 inches) and likely constructed of Barlow rail. Barlow rail comprised one piece of rolled steel designed to be laid directly onto the rail ballast without the need for sleepers (NetworkRail nd). Barlow rail was commonly used on early lines with little traffic such as breakwaters. Narrow gauge was typical of breakwaters and would have been used along the breakwater for skip wagons filled with sand stone blocks. When the line was changed to standard gauge (4 feet 8 inches) rail wagons could continue on the rail line from the Waratah quarry right along the breakwater (L. Greentree pers. comm. 9 March 2016).

Between 1875 and 1883 the breakwater was extended beyond Nobbys using the railway to transport the stone. In 1896 the breakwater was further extended when the railway line was re-laid to allow the movement of stones weighing up to 30 tons (Turner 1994:6-7) (refer to Plates 2.3 and 2.4).

The railway remained in use into the early twentieth century for the maintenance of the breakwater and to transport sand from the sand siding located in the Nobbys Beach sand dunes (refer to Section 2.4.4) to the mainland (Suters 1997 Inventory Datasheet 1002).

There were three lines associated with the rail line at Nobbys:

- the Breakwater Line extending along the full length of the breakwater;
- the Sand Siding line which branched off the Breakwater line before Nobbys Head to allow for the mining of sand from the sand dunes between Nobbys Head and what is now Nobbys Beach; and
- Wave Trap line around the west side of current Nobbys Beach Reserve to the west side of Horseshoe Beach.

Plate 2.3

Undated Photograph ‘Rail line leading out to breakwater of Nobbys’

Source: Hunter Photobank
(Registration number 16301960)

Plate 2.4

1892 Photograph showing Nobbys Head Railway from North end of Breakwater

Source: Hunter Photobank
(Registration number 0010001070)
2.4.4 Sand Siding and Sand Pit

The construction of the breakwater resulted in sand dunes being formed between Nobbys Head and what is now Nobbys Beach. A sand pit (sand quarry) was established in the sand dunes and a branch line was constructed from the Breakwater line to service the sand pit. The sand pit and siding were likely utilised approximately between the late 1920s to late 1950s.

The use of sand in railways has always been important, trains today still have a sandbox to dispense sand onto the rails. Sand increases the adhesion of the trains’ wheels to the rail tracks. The windblown sand that forms sand dunes is ideal as it contains less additional material such as shell (L. Greentree pers. comm. 9 March 2016).

Information in the Department of Railways, New South Wales *Local Appendix to the Working Timetable* provides information relating to the operation of the sand siding. In the 1929 Local Appendix there is no mention of a sand siding at Nobbys Beach. The 1929/1930 Newcastle Diagram of Yard and Signalling Arrangements shows the Wave Trap line and the Breakwater Line but no line to the sand dunes. There is a Sand Dump indicated on the plan which suggests sand may have been collected there by that time (refer to Plate 2.5). An aerial photograph dated approximately to the 1920s clearly shows the sand siding suggesting it was operational by the late 1920s (refer to Plate 2.6).
The Nobbys Sand Siding leading the sand pit in the sand dunes of Nobbys Beach is mentioned in the 1936 *Local Appendix to the Working Timetable*:

*Engines of all classes may be run on this siding but no engine, except a “19” or “20” class, is to be allowed to proceed beyond the points, situated on the breakwater, leading to the sand pit* (Department of Railways, New South Wales 1936).

Nobbys Sand Siding and the sand pit are also discussed in the 1937 Local Appendix:

*Engines of all classes may be run on this siding as far as the point situated on the breakwater leading to the sand pit. Beyond the points indicated engines of the light type, also 26 and 30 class, only are allowed to run* (Department of Railways, New South Wales 1937).

The 1936 Newcastle Diagram of Yard and Signalling Arrangements indicates a line going to ‘Breakwater Road and Sand Pit Siding’ (refer to Plate 2.7).
A 1945 Department of Railways NSW Way And Works Branch plan details the Newcastle Nobbys Sand Pit. The plan shows both an in and out line to the siding in the sand dunes. The plan also shows that the line out to the end of the breakwater is still in situ and details the Waratah stone built breakwater wall (refer to Plate 2.8). The breakwater line is indicated as the Public Works Department (P.W.D.) siding. With the onset of World War 2 sand was increasingly utilised for construction works. A 1934 aerial photograph also shows the in and out lines in the sand dunes (refer to Plate 2.9).
Plate 2.8
1945 Department of Railways NSW Way And Works Branch plan

Plan shows the Sand Siding lines (red arrow), the Breakwater Line (blue arrow) and the Waratah stone built wall on the harbour side of the breakwater (green arrow).

Source: Australian Railway Historical Society
A 1950s New South Wales Railway Newcastle and Maitland Railways map shows no branch line to the Waratah quarry, however it does still show the sand siding. No line is shown continuing to the end of the breakwater by this date (refer to Plate 2.10).
The 1961 *Local Appendix to the Working Timetable* has no mention of the sand siding but it is shown as still being intact, suggesting that the sand siding and sand pit were likely defunct by the 1960s.

**Plate 2.11** shows the breakwater line and the line branching off to the Sand Siding. **Plates 2.12 and 2.13** show the surviving evidence for the Sand Siding line.

**Plate 2.11**

Undated photograph showing the breakwater with Nobby’s Railway.

Photograph shows the line branching off to the Sand Siding

Source: Newcastle Herald May 22 2014

**Plate 2.12**

View to northeast showing current breakwater pathway

The former rail line and branch off to the former sand siding are evident as cracks in the pathway surface

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2.4.5 Wave Trap line and the Explosives Siding

The wave trap was a small breakwater located at the western end of Horseshoe Beach (refer to Plates 2.6 and 2.9). There was also an Explosive’s Siding located there (refer to Plate 3.14). The 1929/1930 NSWR Newcastle Diagram of Yard and Signalling Arrangements indicates both the Wave Trap line and the Explosives Siding (refer to Plate 2.5). An article in the Newcastle Morning Herald and Miners Advocate 28 November 1978 discusses that

...when mines needed more gun powder, supplies would be unloaded from the Soudan onto barges. These were towed to the small breakwater known as the Wavetrap, on Horseshoe Beach. The powder was transferred from the barges onto the Wavetrap and men like those pictured loaded the boxes into the rail trucks that were then taken to the mines.
2.4.6 The Nobby’s Shanty Town and Camp Shortland

During the Great Depression camps or shanty towns were established on Newcastle’s beaches for unemployed men. By July 1930 there were approximately 170 unemployed men camped around Newcastle’s beaches. One of the main camps was a large camp established by the State and Commonwealth Governments on Horseshoe Beach on the western side of the Southern Breakwater (refer to Plates 2.15 and 2.16). In 1937 when Nobby’s Shanty town comprised 81 shacks housing 144 people it was removed on the grounds that the site was required by the Defence Department as a parade ground. Subsequently the army camp known as Camp Shortland replaced the shanty town on the west side of the breakwater (Turner 1994:13-14) (refer to Plates 2.17 and 2.18).
Newspaper photograph showing Nobbys Shanty Town

Photograph taken prior to the Shanty Town area being acquired by the Defence Department

Source: Norm Barney Photographic Collection Cultural Collections University of Newcastle, NSW

1961 aerial photograph. Photograph shows the rail yards, rail lines leading to the edge of the Breakwater, Camp Shortland and Zaara Street Power Station

Source: Newcastle City Council
Plate 2.18

1963 aerial photograph

Photograph shows the rail yards, Camp Shortland and Zaara Street Power Station

Source: Hunter Photobank (Reg. No. 104008790)
3.0 Summary of Results

Visual inspection (refer to Plate 3.1) and ground penetrating radar (GPR) testing (refer to Section 3.1.1) undertaken in 2014 indicated the presence of the former Nobbys Head Rail line beneath the surface of Nobbys Road. As such, the main area of focus for the archaeological monitoring was the portion of Nobby’s Road known to have evidence of the former line.

A photographic record of the results of the archaeological monitoring comprising a photographic catalogue, thumbnail image sheets (proof sheets) of the photographs and a DVD of all photographs is included as Appendix 1 to this report.

3.1 Nobbys Head Railway

3.1.1 Ground Penetrating Radar – Nobbys Road

As discussed GPR testing was undertaken along Nobbys Road during the design phase of the Bathers Way with the intent of identifying the potential extent of evidence relating to Nobbys Head Railway.

The results of the GPR testing confirmed the extent of the rail line evident in the surface of Nobbys Road and suggested that both rails and sleepers may be present immediately below the surface of the road (refer to Plate 3.1). The results of the GPR testing are included as Appendix 2.

Plate 3.1

View to southwest showing pre-excavation detail of rail beneath Nobbys Road

© Umwelt, 2014

3.1.2 Archaeological Monitoring

Appendix 3 provides a plan of the portion of the Nobbys Head Railway exposed during the archaeological monitoring. Up to 200 millimetres of bitumen road surface and compact road base lying directly on top of the rails and sleepers was removed by machine (refer to Plate 3.2). Two separate areas of the rail line were
exposed; the main section beneath Nobbys Road and a smaller section at the commencement of the breakwater pathway.

The main north to south aligned section of rail line located beneath Nobbys Road comprised of up to 20 metres length of standard gauge track constructed using flat bottomed rail and associated sleepers (refer to Plates 3.3 to 3.6). The sleepers were up to 2.80 metres in length and 250 millimetres in width laid approximately 450 to 550 millimetres apart. The sleepers were laid directly onto compact sand and there was some remnant mixed fill comprised of sand, ash, coal, slag, shell and gravels between the sleepers. Straight dog spikes fixed the rails to the sleepers; up to three or four dog spikes being used in some cases potentially indicating the need for constant maintenance of the line and the likely soft shifting nature of the sand beneath (refer to Plate 3.7). The lengths of rail used, as indicated by the location of fish plates (a metal bar that is bolted to the ends of two rails to join them together in a track) joining the rails, included 12.20 metre and 10.30 metre lengths (refer to Plate 3.8).

The second smaller section of rail comprised a short length (approximately 2 metres) of the flat bottomed rail which continues beneath the current breakwater surface and the ‘shadow’ of a former sleeper in the underlying sand (refer to Plates 3.9 to 3.10).

The exposed section of rail line is likely to date to 1896 when the rail line was re-laid to allow the transportation of stones weighing up to 30 tons to extend the breakwater. The line may have also been changed from narrow to standard gauge at this time allowing rail wagons to continue along the main rail system from the Waratah quarry right along the breakwater.

The exposed section of former rail line discussed and detailed in this report was removed as a result of the levels required for the new Bathers Way footpath surface. The alignment of the Nobbys Head Railway has been interpreted as an element in the Bathers Way (refer to Section 3.1.3).
Plate 3.3

View to northeast showing exposed rail line

Scale = 1 metre

© Umwelt, 2014

Plate 3.4

View to southwest showing exposed rail line

Scale = 1 metre

© Umwelt, 2014
Plate 3.5

View to west showing exposed rail line

© Umwelt, 2014

Plate 3.6

View to northwest showing exposed rail line

© Umwelt, 2014
Plate 3.7

Detail of dog spikes

© Umwelt, 2014
Plate 3.8

Detail of fish plate

© Umwelt, 2014

Plate 3.9

View to northeast showing exposed northern section of rail line

Scale = 1 metre

© Umwelt, 2014
3.1.3 Interpretation of Exposed Rail Line

Newcastle City Council has incorporated the alignment of the Nobbys Head Railway as an element in the art works along the Nobbys Road section of Bathers Way. The interpretative artwork comprises the portion of Nobbys Head Railway (rail and sleepers) as exposed during the archaeological monitoring and key historical dates and events including:

- the early exploration and discovery of Newcastle by Captain James Cook and Lieutenant John Shortland;
- Macquaire’s Pier;
- the Southern Breakwater; and
- Nobbys Head Railway.

The artwork was ‘etched’ into the new pathway by abrasive blasting. Appendix 4 details the interpretive artwork as installed.

3.2 Southern Breakwater

Landscaping works between the car park and the shared pathway (refer to Figure 1.3) exposed a north to south running alignment of sandstone blocks (refer to Plates 3.11 and 3.12). The sandstone blocks comprised the grey blue coloured Waratah sandstone used from 1869 to repair and extend the Southern Breakwater. The 8 June 1869 Maitland Mercury article describing the repair works discusses
...The harbour side of the breakwater, so far as it has been repaired, is being faced with hand-pitched stone, built in and bonded on a natural slope, which gives a finished appearance to the work (Maitland Mercury 8 June 1869).

The 1945 Department of Railways NSW Way And Works Branch plan (refer to Plate 2.8) details the stone built breakwater wall on the harbour side of the breakwater.

Excavation for tree planting further exposed the harbour side face of the breakwater wall. As described in the Maitland Mercury article it comprised a sandstone constructed revetment wall maintaining the slope of the harbour side face of the breakwater capped with a single course of larger sandstone blocks (refer to Plates 3.13 and 3.14). The same alignment of sandstone blocks are currently exposed along the full length of the breakwater. The sloping sandstone retaining wall beneath the large capping blocks has, in general, been faced with concrete (refer to Plate 3.15). Plate 3.16 is an undated photograph showing breakwater and rail line with the Waratah sandstone running along the harbour side edge of the breakwater.

The exposed sandstone blocks and revetment wall were retained in situ and protected with geo-fabric before the landscaping works were undertaken. The locations of the new trees were moved a small distance to the west, away from the breakwater wall, to further protect the western harbour side face of the wall.

Plate 3.11

View to northeast showing exposed breakwater sandstone blocks

© Umwelt, 2014
Plate 3.12
View to southwest showing exposed breakwater sandstone blocks and proposed tree location

© Umwelt, 2014

Plate 3.13
View to east showing detail of exposed section of breakwater wall

© Umwelt, 2014
Plate 3.14

View to east showing detail of exposed section of breakwater wall

© Umwelt, 2014

Plate 3.15

View to southwest along breakwater

Photograph shows the exposed sandstone blocks and concreted revetment wall of the breakwater

© Umwelt, 2014
3.3 Camp Shortland

Works associated with the construction of the new car park at Nobbys Beach exposed two concrete blocks in the southwest corner of the Project area (refer to Plates 3.16 to 3.17 and Appendix 3).

The blocks measured approximately 900 by 850 millimetres and were over 250 millimetres in depth. They were made from concrete with a coarse large pebble aggregate. The surface of the concrete appears to have been stained with iron oxide. The concrete blocks have an L-shaped arrangement of reinforcing bars. The blocks likely form the footings for a structure that was located to the west, or form a machine (possibly crane) base.

The blocks are located at the southeast corner of the former Camp Shortland and are likely associated with the Camp Shortland period use of the west side of the breakwater. The blocks were retained in situ beneath the landscaped surface of Nobbys Beach Reserve.
Plate 3.17

View to northeast showing concrete blocks

Scale = 1 metre

© Umwelt, 2014

Plate 3.18

View to southwest showing concrete blocks

© Umwelt, 2014
4.0 References


Department of Railways, New South Wales 1936 Circular No. 83-3 Instructions to Station Masters, Guards, Drivers, and all other concerned

Department of Railways, New South Wales 1937 Circular No. 291-11 Instructions to Station Masters, Guards, Drivers, and all other concerned


Maitland Mercury and Hunter River General Advertiser 8 June 1869 Harbour Works at Newcastle.


APPENDIX 1
Photographic Record
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APPENDIX 2

Results of Ground Penetrating Radar
4th August 2014

FAO: Mr Ryan Tranter
The City of Newcastle
282 King Street
Newcastle, NSW 2300

SUBSURFACE INVESTIGATION USING GROUND PENETRATING RADAR TO LOCATE HISTORIC RAILWAY TRACKS, NOBBYS ROAD, NEWCASTLE.

This investigation work was commissioned by Mr Ryan Tranter on behalf of the City of Newcastle. The purpose of the investigation is to determine the location of the railway tracks and any sleeper bed using geophysical means including Ground Penetrating Radar (GPR). The data collection, processing and analysis were undertaken by staff from GBG Australia Pty Ltd in order to identify probable archaeological remains of the tracks for possible future construction work.

As the techniques used in this investigation are geophysical, the results are based on indirect measurements and the interpretation of electrical signals. The findings in this report represent the best professional opinions of the author, based on their experience and with consideration of the expected subsurface anomalies at the investigation site.

The following report outlines the investigation and discusses the results.
SURVEY AREA AND TIMING

The rail tracks are located within a section of Nobbys Road, approximately 1 km north east of the Newcastle CBD. The area investigated during this survey is outlined in the image below, see Figure 1. The areas were clear of obstructions. However, no GPR data could be collected where vehicles were parked and traffic control was utilised to minimise traffic movement in the area.

The GPR field work was conducted by a two person crew from GBG, with the field work being undertaken on the 23rd July 2014.

Figure 1: Nearmap image of the showing the approximate locations of the investigation area along Nobbys Road, Newcastle. The sites included areas of roadway and paved parking areas.
BACKGROUND

As we understand it council plan to close off the section of Nobby’s road where the car park is to construct a wide pedestrian path. This entails the removal of any rail track and sleeper beds present. The location surveyed is part of the city heritage precinct and as a result there was a requirement to investigate all options to retain, reinterpret, and document the existing buried infrastructure. There is also a criteria of good management practice in gaining a better understanding of what is buried beneath the current road surface, prior to designing and undertaking the construction to limit risk and variation in costs.

GROUND PENETRATING RADAR THEORY

GPR is a non-destructive technique that provides high resolution reflection profiles of the subsurface. The technique works by pulsing radio waves, into the subsurface with a transmitting antenna. This energy propagates through the subsurface material as a function of its electrical properties which are in turn a function of its physical and chemical properties. Reflection of energy occurs at boundaries between media which have contrasting electrical properties such as a between soil material and bedrock material. These reflections are detected by the receiving antenna and converted into electrical signals.

A radar gram profile is built up of individual scans collected continuously along a selected line path. Each profile consists of radio imaging which provides subsurface information based on the variations in the Dielectric Constants (the electrical conductivity and resistivity) of materials. The recorded reflections can be analysed in terms of the signal shape, phase, travel time and signal amplitude to provide information about a target’s size, depth and orientation in relation to the material around it.

GPR antennas of high frequency provide high resolution data, but only penetrate to shallow depths, whilst low frequency antennae provide deeper penetration with decreased resolution. The depth of penetration achievable with an antenna of a particular frequency is also dependant on the local subsurface conditions. GPR is a method that is generally less successful in soils with high clay content due to the clay’s high absorption factor of radio wave energy. Clean dry sands provide an ideal medium for the propagation of radar waves.

DATA COLLECTION METHODOLOGY

The GPR data for this investigation was acquired using a GSSI SIR3000 GPR data collection system with ground coupled 900 MHz and 500 MHz centre-frequency antennas.

Chainages along the profile line were logged by a calibrated distance measuring device attached to the antenna, with an accuracy of better than ±1 m every 100 m.

GPR data was collected as a series of transverse profiles perpendicular to the kerb and expected direction of the rail track and a series of longitudinal profiles to ascertain information on possible sleepers associated with the rail tracks.
GPR profile lines were collected by pushing the 900 MHz and 500 MHz antennas over the ground surface at a constant rate. The GPR system was set to record a two-way-travel time of between 24 ns and 60 ns, respectively. Data was recorded with 16-bit resolution, at 512 samples per scan and at a scan rate of 100 scans/m. The 500 MHz was used only to supplement the 900 MHz and to achieve greater depth of penetration.

The GPR profiles were collected at line spacing of between 0.5 m for longitudinal lines and 1 m for transverse lines.

Field notes recording the offset position and the start and end chainages of the GPR profile lines were taken. On-site quality control of the data was achieved in real-time by viewing profiles during acquisition. The profiles were recorded digitally for processing, analysis and interpretation at our Sydney office.

A DGPS unit was used to collect a series of points allowing for the survey to be georeferenced and thus allowing for anomalies to be located and mapped.

DATA PROCESSING AND ANALYSIS

Ground Penetrating Radar

The collected data was of moderate quality with low signal to noise ratio in the areas surveyed. This was principally due to the local subsurface, fill material. Fill material by its very nature can typically create a large amount of clutter within the reflected signal. This can be partially overcome during processing by applying various filters to the data.

The collected GPR data was processed and analysed using Reflex for Windows Version 7.0.0 developed by Sandmeier Software. The data processing steps were performed as follows:

- Static correction to set the surface reflection interface to zero depth.
- Background removal filter used to eliminate temporally flat noise bands from across the whole record. This makes signals previously obscured by this noise visible.
- Adjust the colour palette for signal amplitudes to improve the contrast of phase changes and signal variation.
- Migration to remove diffraction patterns emanating from small targets. This makes the image cleaner and easier to understand.

Radar signals reflected from a subsurface structure contain a large amount of visual information much relating to the minor variations in the electrical properties of the materials profiled. Consideration was given to the nature and possible cause of the signals recorded by the GPR. The target responses which are consistent with those expected from possible archaeological or building features were identified in the profiles and compared across multiple profiles. A sample radargram collected during this investigation are shown in
Figures 2 and Figure 3 below. The profile is of identified feature interpreted as railway tracks and sleepers.

Figure 2: Transverse profile across Nobbys Road from the 900 Mhz antenna, showing the location of possible railway tracks under Nobbys Road.

Figure 3: Longitudinal profile across along Nobbys Road from the 900 Mhz antenna, showing the location of possible sleeper bed associated with the railway under Nobbys Road.

RESULTS AND DISCUSSION

The results of the GPR investigation have been plotted in the attached drawings GBGA1734-01 at a scale of 1:250. The locations of the collected GPR profiles are plotted as green lines. Other features are shown as per the legends and as described below. All of the features that have been identified within the data occur in the near surface (<1m). No deeper features were identified due to absorption of signal at increased depth likely caused by road base materials and fill or by attenuation of the radar signal caused by the presence of ground salinity or groundwater.

The railway track was mapped successfully and is shown in drawing GBGA1734-01 as magenta polylines with depths ranging from 30mm for the northern rail section to 20mm for the southern rail section. From observations onsite, and compared to the results of the GPR, the rails curve to west towards the current parking area adjacent to Nobby road. It also appears that a section of rail has been removed in previous construction work as there is an absence of any evidence of the rail tracks between the southern and northern sections. As well as the rail tracks there is also evidence to suggest that sleepers are also present in the locations that still contain rail tracks. These have been marked in drawing GBGA1734-01 as blue hashed areas.
The rail track appears to be 1.6m between rails (broad gauge) which much wider than standard gauge (1.435m). The sleepers appear to be approximately 2.6m long where clearly visible and occur at 0.5m centres.

A number of other linear features not associated with the railway were identified in the GPR data. These have been marked in the drawing as Cyan polylines and could be associated to current or redundant services. A detailed service location survey is recommended in order to determine the likelihood of these features being services and to identify which service they correspond to.

**CONCLUSIONS**

The GPR investigation was performed over the expected location of the railway tracks along Nobbys Road, Newcastle, NSW.

Scaled investigation plan drawings have been overlaid onto geo-referenced aerial images. The locations of possible subsurface anomalies interpreted from the data collected at the site have been plotted.

The data from the GPR survey have found a number of anomalies that directly relate to the remains of the railway line. As well as the track itself, sleepers associated with the track are also evident within the data.

A number of other linear features not associate with the railway were identified in the survey area. These have the possibility of being services and as a result it is recommended that you perform an in-depth service location to ascertain the nature of these features.

I hope that this report provides you with the information required by your brief. If you require clarification on any points arising from this investigation please contact me.

For and on behalf of

**GBG AUSTRALIA PTY LTD**

**TRENT BOWMAN**

Geophysicist

**Attachments: DRAWING GBGA1734-01 as Electronic Portable Document Files (PDFs)**
1349 BATHERS WAY
UNEARTHED EXISTING RAIL LINE
APPENDIX 4
Interpretive Design
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<td>Ph. 02 4950 5322</td>
<td><a href="http://www.umwelt.com.au">www.umwelt.com.au</a></td>
</tr>
<tr>
<td>Perth</td>
<td>PO Box 8177, Subiaco East WA 6008, 33 Ventnor Avenue, West Perth WA 6005</td>
<td>Ph. 08 6260 0700</td>
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<tr>
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<td>Ph. 02 6262 9484</td>
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<tr>
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<td>Ph. 1300 793 267</td>
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<tr>
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