The Horsley Drive Upgrade
Environmental Investigation Report
Appendix L– Statement of heritage impact (Non-Aboriginal Heritage)

June 2017
The Horsley Drive Upgrade

Statement of Heritage Impact

Prepared by:

RPS AUSTRALIA EAST PTY LTD

Level 13, 255 Pitt Street,
Sydney, New South Wales 2000

T: 02 9248 9800
E: sydney@rpsgroup.com.au

Prepared for:

ROADS AND MARITIME SERVICES

PO Box 973
PARRAMATTA NSW 2124

T: 131 782
E:
W:

Prepared by: Deborah Farina
Reviewed: Erin Williams
Approved: Erin Williams
Project No.: PR130033
Version: 8.3
Date: June 2017
IMPORTANT NOTE

Apart from fair dealing for the purposes of private study, research, criticism, or review as permitted under the Copyright Act, no part of this report, its attachments or appendices may be reproduced by any process without the written consent of RPS Australia East Pty Ltd. All enquiries should be directed to RPS Australia East Pty Ltd.

We have prepared this report for the sole purposes of Roads and Maritime Services (“Client”) for the specific purpose of only for which it is supplied (“Purpose”). This report is strictly limited to the purpose and the facts and matters stated in it and does not apply directly or indirectly and will not be used for any other application, purpose, use or matter.

In preparing this report we have made certain assumptions. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

This report is presented without the assumption of a duty of care to any other person (other than the Client) (“Third Party”). The report may not contain sufficient information for the purposes of a Third Party or for other uses. Without the prior written consent of RPS Australia East Pty Ltd:

(a) this report may not be relied on by a Third Party; and

(b) RPS Australia East Pty Ltd will not be liable to a Third Party for any loss, damage, liability or claim arising out of or incidental to a Third Party publishing, using or relying on the facts, content, opinions or subject matter contained in this report.

If a Third Party uses or relies on the facts, content, opinions or subject matter contained in this report with or without the consent of RPS Australia East Pty Ltd, RPS Australia East Pty Ltd disclaims all risk and releases and indemnifies and agrees to keep indemnified RPS Australia East Pty Ltd from any loss, damage, claim or liability arising directly or indirectly from the use of or reliance on this report.

In this note, a reference to loss and damage includes past and prospective economic loss, loss of profits, damage to property, injury to any person (including death) costs and expenses incurred in taking measures to prevent, mitigate or rectify any harm, loss of opportunity, legal costs, compensation, interest and any other direct, indirect, consequential or financial or other loss.

DOCUMENT STATUS

<table>
<thead>
<tr>
<th>Version</th>
<th>Purpose of Document</th>
<th>Orig</th>
<th>Review</th>
<th>Review Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Draft Non Aboriginal (Historic) Heritage Working Paper for client review – preferred option not yet finalised</td>
<td>Deborah Farina</td>
<td>Erin Williams</td>
<td>05/08/2016</td>
</tr>
<tr>
<td>2.0</td>
<td>Draft Non Aboriginal (Historic) Heritage Working Papr following GHD/RMS comments – preferred option not yet finalised</td>
<td>Deborah Farina</td>
<td>Erin Williams</td>
<td>15/08/2016</td>
</tr>
<tr>
<td>3.0</td>
<td>Final Statement of Heritage Impact following finalisation of preferred option</td>
<td>Deborah Farina</td>
<td>Erin Williams</td>
<td>05/12/2016</td>
</tr>
<tr>
<td>4.0</td>
<td>Final Statement of Heritage Impact following further client comment</td>
<td>Deborah Farina</td>
<td>Erin Williams</td>
<td>02/03/2017</td>
</tr>
<tr>
<td>5.0</td>
<td>Final Statement of Heritage Impact following further client and Water NSW comment</td>
<td>Deborah Farina</td>
<td>Erin Williams</td>
<td>21/04/2017</td>
</tr>
<tr>
<td>6.0</td>
<td>Final Statement of Heritage Impact following further client comment</td>
<td>Deborah Farina</td>
<td>Erin Williams</td>
<td>08/05/2017</td>
</tr>
<tr>
<td>7.0</td>
<td>Final Statement of heritage Impact following further client comment</td>
<td>Deborah Farina</td>
<td>Erin Williams</td>
<td>29/05/2017</td>
</tr>
</tbody>
</table>
Version | Purpose of Document | Orig      | Review     | Review Date
--------|---------------------|-----------|------------|---------------
8.0      | Final Statement of Heritage Impact following further client comment | Deborah Farina | Erin Williams | 13/06/2017

APPROVAL FOR ISSUE

<table>
<thead>
<tr>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erin Williams</td>
<td></td>
<td>13/06/2017</td>
</tr>
</tbody>
</table>
Executive Summary

RPS Australia East Pty Ltd was commissioned by RPS Manidis Roberts on behalf of Roads and Maritime Services (Roads and Maritime) (the Proponent) to prepare a Statement of Heritage Impact (SoHI) as part of the Review of Environmental Factors for the upgrade of The Horsley Drive between Cowpasture Road, Bossley Park in the east and the M7 Westlink Motorway in the west. The purpose of this assessment is to consider all non Aboriginal heritage items and landscapes that may be affected by the upgrade within the preferred option corridor, to assess the impact on the heritage items by the proposed upgrade and to identify appropriate management and mitigation measures, as well as any required permitting. This assessment has been prepared as part of the Concept stage of the project and will inform an Environmental Investigation Report (EIR).

The Proposal Area considered in this assessment is The Horsley Drive alignment between Cowpasture Road, Bossley Park in the east and Wallgrove Road, Horsley Park in the west. The length of the Proposal Area is approximately 2.4 kilometres (see Figure 1).

This assessment has been prepared in accordance with The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (Burra Charter) (2013) and associated Guidelines as well as best practice standards set by the NSW Heritage Branch. Best practice guidance followed in this report includes Assessing Heritage Significance (Heritage Officer (former), 2001), Statements of Heritage Impact (Heritage Office and Department of Urban Affairs and Planning 1996) and Levels of Heritage Significance (Heritage Council of NSW 2008).

Searches of the statutory heritage databases indicate that there are two heritage items within the Proposal Area, one being the Upper Canal System (Pheasants Nest Weir to Prospect Reservoir), an item of State significance listed on the State Heritage Register, and the other being a Bunya Pine on the north western intersection of The Horsley Drive and Cowpasture Road, listed in the State Environmental Planning Policy Western Sydney Parklands 2009 as an item of local heritage significance.

The Upper Canal System feeds directly into Prospect Reservoir approximately two kilometres to the north and bisects The Horsley Drive in a roughly north-south alignment midway along the portion of The Horsley Drive within the Proposal Area. The Canal was part of the early permanent water delivery scheme to residents of Sydney and has historical, technical, research and rarity heritage values. The owner of the item is Water NSW, with whom the client has maintained regular consultation with regarding this Proposal.

The Bunya Pine marks the entrance to Horsley Park homestead, another item of state significance located approximately three kilometres to the west of the pine. The alignment of The Horsley Drive roughly follows the carriageway from Cowpasture Road to the homestead, with the Bunya pine being the last of two marker trees for the carriageway. The Horsley Park homestead is located approximately 1.2 kilometres to the west of the Proposal area.

A site inspection was undertaken on 23 June 2016 by RPS Heritage Consultant, Alexandra Byrne. No further items of heritage significance or areas of historic archaeological significance were identified as a result of the site inspection.

The only impact to non Aboriginal heritage as a result of the Proposal may be to Weston’s Tunnel, which is part of the State heritage-listed Upper Canal System (Pheasants Nest Weir to Prospect Reservoir). As the activity cannot be classified as minor, a s60 permit under the Heritage Act 1977 will need to be sought from the Heritage Division of the Office of Environment & Heritage prior to any construction works commencing. The approvals process of this permit can be between six to twelve weeks. This will need to be taken into consideration during the staging process.
As much of the proposal area was used for grazing and other agricultural pursuits, it is considered that there is low potential for intact non Aboriginal archaeological deposits to be disturbed in the study area. As a result this investigation, the following management recommendations are made:

**Recommendation 1 – Application for a Section 60 Permit**

It is recommended that application be made to the Heritage Division for a permit under s60 of the *Heritage Act 1977*. An application form must be completed and accompanied by final design plans, including plans for the tunnel crossing, and this Statement of Heritage Impact.

**Recommendation 2 – Vibration mitigation**

It is recommended that the vibration levels set out in GHD’s *Noise and Vibration Assessment (2017)* in relation to the construction in the vicinity of Weston’s Tunnel of the Upper Canal System be followed. Those levels are 3 mm/s vibration velocity level and a minimum buffer distance of five metres from the Canal. It is recommended further that these levels be monitored during construction and alerting any operators who are approaching that level.

**Recommendation 3 – Water NSW Requirements**

It is recommended that consultation with Water NSW continue before, during and after the construction phase and that any works in the vicinity of the Upper Prospect Canal be approved by them prior to commencing. Construction must conform to the Water NSW document *Requirements for protection of Upper Canal Draft (2015)*.

**Recommendation 4 – Dilapidation surveys and restoration**

It is recommended that a dilapidation survey of Weston’s Tunnel be prepared to assess its condition prior to construction. It is recommended further that a dilapidation survey of Weston’s Tunnel brick lining be prepared to assess its condition after construction. Should any change have occurred to the tunnel as a result of the construction it is recommended that RMS engage the services of a contractor experienced in the repair of heritage brickwork to restore the tunnel to its pre-construction condition.

**Recommendation 5 – Temporary construction basin**

It is recommended that the location of the temporary construction basin be negotiated with RMS, Western Sydney Parklands Trust and Water NSW. It is recommended further that the temporary construction basin be constructed at least five metres from the heritage curtilage boundary of the Upper Canal System (as defined on the State Heritage Register). If this is not feasible then an addendum to this Statement of Heritage Impact must be undertaken to assess the potential for any damage to the Upper Canal System as a result of the construction of the temporary construction basin.

**Recommendation 6 – Protection for Bunya Pine**

It is recommended that protective fencing be placed around the foot of the Bunya Pine to avoid accidental damage to the tree through vehicle and plant movement.
Recommendation 7 – Heritage Induction

It is recommended that a heritage induction exercise be carried out in advance of the proposed works. All relevant staff, contractors and subcontractors will be made aware of their statutory obligations for heritage under the Heritage Act 1977, through the site induction and toolbox talks.

Recommendation 8 – Archival Recording

It is considered that the impact on Weston’s tunnel will be a minor negative impact. Consequently, it is recommended that an Archival Recording of Weston’s Tunnel and the associated section of the Upper Canal System is undertaken prior to any works. Such recording should be done in line with the *Photographic Recording of Heritage Items Using Film or Digital Capture* published by the Heritage Division. The recording should also include a photographic record taken from within Water NSW land looking to the north and south of the existing road, as well as the stand of crepe myrtles at the south of The Horsley Drive and the concrete gate posts to the north of The Horsley Drive.

Recommendation 9 – Planting of Screen Trees

In order to safeguard any perceived visual impact to the Upper Canal System by the construction of the new alignment of The Horsley Drive, it is recommended that mature trees are planted along the verges of the crossing of the Upper Canal System by the new alignment.

Recommendation 10 – Unexpected Finds

If, during the course of construction works, suspected archaeological relics as defined by the *Heritage Act 1977* are uncovered, the RMS Unexpected Finds Protocol is to be followed. A copy of this protocol is to be kept on site at all times. If any unexpected finds are identified within the curtilage of the Upper Canal System Water NSW must be notified and a qualified archaeologist engaged to identify the significance of the finds.
Contents

1 INTRODUCTION ...................................................................................................................................... 1
  1.1 Proposal Area ............................................................................................................................ 1
  1.2 The Proposal .............................................................................................................................. 1
  1.3 Key Features of the Proposal ................................................................................................... 1
  1.4 Heritage items within Proposal Area ....................................................................................... 2
  1.5 Tunnel crossing of Upper Canal System ................................................................................ 2
  1.6 Stakeholder consultation .......................................................................................................... 3
  1.7 Methodology .............................................................................................................................. 4
  1.8 Authorship and Acknowledgements ....................................................................................... 4

2 HERITAGE SIGNIFICANCE ASSESSMENT FRAMEWORK ...................................................................... 9
  2.1 Basis of Assessment of Heritage Significance in NSW ........................................................ 9
  2.2 NSW Heritage Registers Review ............................................................................................ 12
  2.3 World Heritage ......................................................................................................................... 13
  2.4 National and Commonwealth Heritage .................................................................................. 13
  2.5 State Heritage........................................................................................................................... 13
  2.6 Section 170 Registers ............................................................................................................. 14
  2.7 Local Heritage.......................................................................................................................... 14
  2.8 Other heritage .......................................................................................................................... 14

3 HISTORICAL CONTEXT ....................................................................................................................... 16
  3.1 Broad Historical Context ........................................................................................................ 16
  3.2 Horsley Estate .......................................................................................................................... 17
  3.3 The Horsley Drive .................................................................................................................... 21
  3.4 Wallgrove Road ....................................................................................................................... 22
  3.5 Cowpasture Road ..................................................................................................................... 22
  3.6 Upper Canal System (Pheasants Nest Weir to Prospect Reservoir) .................................. 23

4 VISUAL INSPECTION ........................................................................................................................... 25
  4.1 General Physical Context ....................................................................................................... 25
  4.2 Heritage Items within the Proposal Area .............................................................................. 26
  4.3 Heritage Item within the Vicinity of the Proposal Area........................................................ 33
  4.4 Archaeological potential ......................................................................................................... 34

5 HERITAGE SIGNIFICANCE ASSESSMENT ........................................................................................ 35
  5.1 Historical Themes in Evidence............................................................................................... 35
  5.2 Significance Assessment ....................................................................................................... 36

6 IMPACT ASSESSMENT ........................................................................................................................ 39
  6.1 Structures Concept Options ................................................................................................... 39
  6.2 Crossing of Upper Canal System – Options considered .................................................... 39
6.3 Impact Assessment of Preferred Option - Assessment of Potential Impact of Tunnel Crossing on Physical Fabric, Attributes and Setting ............................................. 41
6.4 Impact on Potential Archaeological Deposits .............................................................. 45
6.5 Statement of Heritage Impact ................................................................................................. 46
6.6 Permitting ................................................................................................................................. 46
6.7 Temporary Construction Basin Site ...................................................................................... 48
7 CONCLUSION AND RECOMMENDATIONS ........................................................................................ 49
7.1 Conclusion ............................................................................................................................... 49
7.2 Recommendations .................................................................................................................. 49
8 REFERENCES ....................................................................................................................................... 51

Appendices
Appendix A State Heritage Register listing for Upper Canal System ........................................ 53
Appendix B Concept Design Drawings ......................................................................................... 55

Figures
Figure 1 Proposal Area .................................................................................................................... 5
Figure 2 Key Features of Proposal ................................................................................................. 6
Figure 3 Location of heritage items ............................................................................................... 15

Tables
Table 1 Acknowledgements ........................................................................................................... 4
Table 2 Items of State Significance on the SHR ......................................................................... 13
Table 3 Items on s170 Heritage Registers in the study area ......................................................... 14
Table 4 Other statutorily listed heritage items ............................................................................... 14
Table 5 NSW Historical Themes Considered to be in Evidence .................................................. 35
Table 6 Options for crossing of Weston’s Tunnel (Upper Canal System) by AECOM, 2015 (AECOM in GHD 2016:4) ..................................................................................................................... 39
Table 7 Additional options (GHD 2016:5) .................................................................................. 39
Table 8 Guideline values for short term vibration on structures (GHD, 2017:25) ......................... 43
Table 9 Assessment of Option 7B .................................................................................................. 44
Table 10 Notification requirements for standard exemptions ...................................................... 46
Plates

Plate 1 Proposal over Weston Tunnel (Courtesy GHD)................................................................................................................3
Plate 2 Masterplan of Horsley Park Precinct of the Western Sydney Parklands (NSW Government 2012: viii) ..............................................................................................................................................................................11
Plate 3 Map by Lieutenant-Governor and Deputy Judge Advocate David Collins, c 1798, showing location of Prospect Hill in relation to the Proposal Area (Collins 1798) ..................................................................................................................................................................................................................16
Plate 4 Plan of Captain Johnston’s “King’s Gift” grant, outlined in red (Courtesy State Library of New South Wales, M Ser 4 000/1 MSS.1462) ..................................................................................................................................................................................................................18
Plate 5 “Horsley Park” Complex showing carriageway (Courtesy Six Viewer and RPS, 2015) ....................................................19
Plate 6 “Horsley Park” homestead, undated (Courtesy Kathy Curran, Royal Australian Historical Society Librarian, C/- Fairfield Museum and Gallery) ..................................................................................................................................................................................................................19
Plate 7 Outbuildings of “Horsley Park” complex, undated (Courtesy Kathy Curran, Royal Australian Historical Society Librarian, C/- Fairfield Museum and Gallery) ..................................................................................................................................................................................................................20
Plate 8 Detail of Deposited Plan 13961, showing lots 82-92, west of the Upper Canal (Edward Higginbotham and Associates 1997:32) ..................................................................................................................................................................................................................21
Plate 9 Detail from Crown Plan 288-3000 showing Weston’s Tunnel section of the Upper Canal System (Sheet 11) (Courtesy Land & Property Information NSW) ..................................................................................................................................................................................................................23
Plate 10 Upper Canal System, looking south (RPS, 2016) ..................................................................................................................................................................................................................24
Plate 11 The Horsley Drive near Ferrers Road, looking east (RPS, 2016) ..................................................................................................................................................................................................................25
Plate 12 Regional views from The Horsley Drive near the crossing of the Upper Prospect Canal, looking north (RPS, 2016) ..................................................................................................................................................................................................................26
Plate 13 Upper Canal System, south of The Horsley Drive, looking south. The curtilage of the item includes the mown areas shown above (RPS, 2016) ..................................................................................................................................................................................................................27
Plate 14 Grated inlet of Weston’s Tunnel section of Upper Canal System, looking east. The Horsley Drive is located just outside of frame at the top of the rise to the left. Note ashlar blocks (RPS, 2016) ..................................................................................................................................................................................................................28
Plate 15 Weston’s Tunnel outlet, looking south (Courtesy AECOM, 2015:4) ..................................................................................................................................................................................................................28
Plate 16 Above the grated inlet to Weston’s Tunnel. Nameplate (RPS, 2016) ..................................................................................................................................................................................................................29
Plate 17 Grate at the inlet at the southern end of Weston’s tunnel leading from the main canal of the Upper Canal System, looking south (Courtesy AECOM, 2015:6) ..................................................................................................................................................................................................................29
Plate 18 Inlet of Weston’s Tunnel, looking north west (AECOM, 2015:5) ..................................................................................................................................................................................................................30
Plate 19 Detail of brickwork on the interior of Weston’s Tunnel (AECOM, 2015:5) ..................................................................................................................................................................................................................31
Plate 20 The Horsley Drive current crossing of Upper Canal System looking south west. The fencing marks the curtilage of the Upper Canal System (Courtesy Google Earth) ..................................................................................................................................................................................................................31
Plate 21 Upper Canal System, north of The Horsley Drive, looking north-west (RPS, 2016) ..................................................................................................................................................................................................................32
Plate 22 Bunya Pine, looking east (GHD, 2016) ..................................................................................................................................................................................................................33
Plate 23 Upper Canal System, looking north towards the Horsley Drive (RPS, 2016) ..................................................................................................................................................................................................................37
Plate 24 Option 7B for Tunnel Crossing, plan view (Courtesy: GHD, 2016:12) ..................................................................................................................................................................................................................40
Plate 25 The southern side of the Horsley Drive, looking north. The crepe myrtles can be seen in the top middle of frame, to the right of the access trail. The Horsley Drive is beyond the crepe myrtle trees (RPS, 2016) ..................................................................................................................................................................................................................44
1 Introduction

RPS Australia East Pty Ltd was commissioned by RPS Manidis Roberts on behalf of Roads and Maritime Services (Roads and Maritime) (the client) to prepare a Statement of Heritage Impact (SoHI) as part of the Review of Environmental Factors for the upgrade of The Horsley Drive between Cowpasture Road, Bossley Park in the east and the M7 Westlink Motorway in the west. The purpose of this assessment is to consider all non-Aboriginal heritage items and landscapes that may be affected by the upgrade within the preferred option corridor, to assess the impact on the heritage items by the proposed upgrade and to identify appropriate management and mitigation measures, as well as any required permitting.

1.1 Proposal Area

The Proposal Area is The Horsley Drive between Cowpasture Road, Bossley Park in the east and Wallgrove Road, Horsley Park in the west. The length of the Proposal Area is approximately 2.4 kilometres (see Figure 1).

1.2 The Proposal

Roads and Maritime is proposing to upgrade about 2.4 kilometres of The Horsley Drive between the M7 and Cowpasture Road (‘the proposal’). The proposal is located in the suburbs of Horsley Park, Abbotsbury, Bossley Park and Wetherill Park about 30 kilometres west of the Sydney central business district (refer to Figure 1).

The Horsley Drive is a 15 kilometres long state road providing a strategic east-west link between the M7 Westlink Motorway and the Hume Highway. The proposal comprises a 2.4 kilometres section of this road.

The upgrade was announced by the NSW Government in March 2015 to address traffic congestion, improve road safety and to meet a predicted increase in traffic volumes due to growth of the Western Sydney Employment Area. The upgrade would see this section of The Horsley Drive converted from a three/four lanes undivided road to a four-lane divided road with provision for a six lane corridor for future traffic needs. The proposal also includes upgrading the eastern approach of The Horsley Drive at Wallgrove Road intersection. Implementation of the proposal could be in stages subject to the funding availability.

1.3 Key Features of the Proposal

The key features of the proposal are shown in Figure 2 below and include:

- Widening and upgrading approximately 2.4 kilometres of The Horsley Drive from the M7 to Cowpasture Road to a four lane divided road with a wide median to allow for upgrade to six lanes if required in future
- Provision of a third lane from the west of Ferrers Road to Cowpasture Road utilising the future third eastbound lane in the six lane corridor
- Upgrading The Horsley Drive western carriageway between the M7 and Wallgrove Road to provide an additional right turn onto Wallgrove Road with provision for a second westbound lane if required in future
- Upgrading the Horsley Drive / Ferrers Road signalised intersection
- Upgrading the turning lanes at The Horsley Drive / Cowpasture Road North intersection
- Conversion of the existing The Horsley Drive/Cowpasture Road roundabout to a signalised intersection and tie-ins to Cowpasture Road and The Horsley Drive east of Cowpasture Road
Extending turning lanes on The Horsley Drive eastern approach at the M7 interchange
Realignment of a section of The Horsley Drive at the Ferrers Road intersection
Widening and realigning of Ferrers Road at the intersection with The Horsley Drive
 Provision of a turning cul-de-sac opposite Ferrers Road intersection
 Provision of a new access road / shared path between the proposed turning cul-de-sac opposite Ferrers Road intersection to access WaterNSW land and meet the existing Western Sydney Parkland cycle way parallel to the Upper Canal
 An off-road shared path for cyclists and pedestrians on southern side of the road corridor and connection to M7 cycleway and parkland cycleway
 A off-road footpath on northern side of the road corridor
 A Bus priority lane on the western approach and indented bus bays on the departure sides of the Ferrers Road intersection
 Signalised crossings for pedestrians and cyclists at intersections
 Improvements to flood immunity and drainage upgrades including replacing the existing box culverts with a single span concrete bridge to accommodate the proposed widening of The Horsley Drive over Eastern Creek,
 Protection structure over Westons Tunnel to accommodate the proposed road widening over the heritage structure
 Urban design elements including landscaping to integrate with the environment including Western Sydney Parklands
 Adjustments to existing property access
 Temporary access tracks, site compounds, stockpile sites, and construction sedimentation basins.

1.4 Heritage items within Proposal Area

Searches of the relevant databases (see Section 2 below) show that there are two non Aboriginal heritage items located within the Proposal Area, being the Upper Canal System (Pheasants Nest Weir and Prospect Reservoir), and a bunya pine located on the north western corner of Cowpasture Road and The Horsley Drive. Further consideration of the significance and impact on these two items are considered in Sections 5 and 6 below.

1.5 Tunnel crossing of Upper Canal System

The proposed upgrade to The Horsley Drive would include road widening across the State Heritage listed Upper Canal System. The Upper Canal System runs from Pheasants Nest Weir to Prospect Reservoir, a distance of approximately 64 kilometres (Heritage Division 2006). The Weston Tunnel (also known in some historical sources as the Weston's Creek Tunnel) runs beneath The Horsley Drive as part of the Upper Canal System for a distance of approximately 134 metres. The internal dimensions of the oval tunnel are 2.85 metres in width and 2.4 metres in height. Existing plans place the obvert of the tunnel approximately 7.4 below the existing road's surface (AECOM 2015). The existing width of The Horsley Drive over the Weston Tunnel is about 14.0 metres and the proposed width would be about 37.5 metres.
Several options were considered for the tunnel crossing with two options shortlisted for the preferred option, being Options 3 and 7B. Both would have a similar configuration as shown in Plate 1 but with different vertical profiles. In both options piles would be bored, which would not involve hard driving, to reduce vibration on the tunnel structure. These options are discussed at Section 6 below.

Plate 1 Proposal over Weston Tunnel (Courtesy GHD).

1.6 Stakeholder consultation

Various government agencies and stakeholders have been consulted about the proposal, including:

- Fairfield City Council
- WaterNSW
- Western Sydney Parklands Trust (WSPT)
- Transport for NSW
- Department of Primary Industries, Fisheries
- Office of Sport
- State Emergency Services
- Utilities including Endeavour Energy, Jemena, Sydney Water, Telstra, Uecomm, Optus, NBN Co, Pipe Networks
- Cumberland Business Chamber
- Local businesses:
  - Kennards Self Storage;
  - Sharks Gold Driving Range
- BP Horsley Park Petrol Station.
1.7 Methodology

This Heritage Assessment has been prepared in accordance with *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (Burra Charter)* (2013) and associated Guidelines as well as best practice standards set by the NSW Heritage Branch. Best practice guidance followed in this report includes *Assessing Heritage Significance* (Heritage Officer (former), 2001) and *Levels of Heritage significance* (Heritage Council of NSW 2008).

This investigation builds on information previously gathered by Hills Environment as part of the *Preferred Corridor Option Report* (2015).

1.8 Authorship and Acknowledgements

This report has been prepared by RPS Heritage Manager Sydney, Deborah Farina. It was reviewed by Senior Executive – Environment and Heritage, Erin Williams. RPS Senior Spatial Analyst Hamidreza Karimi provided mapping and GIS data.

RPS would also like to acknowledge the assistance of the following people and organisations in the preparation of this report.

**Table 1 Acknowledgements**

<table>
<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyndall Thornhill, Jon Williamson, Hugh Swinbourne</td>
<td>RPS Manidis Roberts</td>
</tr>
<tr>
<td>Devika Sitinamaluwe, Melissa Huntsman, Ian Berger</td>
<td>Roads and Maritime Service, NSW</td>
</tr>
<tr>
<td>Karen Yale</td>
<td>GHD</td>
</tr>
</tbody>
</table>
Figure 1
Proposal location
Figure 2

Key features of the proposal
Figure 1-2a
Key features of the proposal
Figure 1-2b
Key features of the proposal

- Upgrade existing traffic control signals on Ferrers Road
- Provision of a turning cul-de-sac
- Provision of a new access road / shared path / cycle way
- Upgrade existing traffic control signals on Cowpasture Road
- Conversion of the existing roundabout to a signalised intersection
- Three lanes eastbound
- Lizard Log entrance road
- Compound Site 4
- Compound Site 1
- Weston Tunnel
- Bridge structure over Weston Tunnel
- WaterNSW Upper Canal
- Western Sydney Parkland
- Lizard Log
- Lachlan Street
- Serpentine Street
- Warragamba Creek
- Quarry Road
- Castlereagh Street
- Murrumbidgee Street
- Broadway Street
- Railway Avenue
- Horsley Drive
- Ludden Close
- TOOHEY ROAD
- NEWARK ROAD
- WESTON TUNNEL
- COWPASTURE ROAD
- LIZARD LOG
- DURIAN PLACE
- BENTLEY STREET
- HALLSTROM PLACE
- LEGEND
  - Proposal site
  - Proposed compound sites
  - Reserves
  - Waterbodies
  - Waterways
  - Roads
  - Existing bus stop
  - Indicative proposed bus stop
  - Barriers, kerb features, road and bitumen edges, gutter flow lines, footpaths
  - Earthworks and ground interface
  - Line markings
  - Driveways and side roads
  - Road design

2 Heritage Significance Assessment Framework

2.1 Basis of Assessment of Heritage Significance in NSW

The following section provides an overview of the legislative framework relating to the protection and management of historic heritage. This overview is provided solely as information for the client rather than as legal advice. The findings from a review of national, state and local statutory heritage registers are provided in Section 2.2 below.

Heritage Act 1977 and the NSW Heritage Division

Historical archaeological relics, buildings, structures, archaeological deposits and features are protected under the *Heritage Act 1977* (and subsequent amendments) and may be identified on the State Heritage Register (SHR) or by an active Interim Heritage Order.

The Heritage Council of NSW, constituted under the *Heritage Act 1977*, is appointed by the Minister and is responsible for the protection of non Aboriginal heritage in NSW. The Council reflects a cross-section of community, government and conservation expertise with the NSW Heritage Division being the operational arm of the Council. The work of the NSW Heritage Division includes:

- Working with communities to help them identify their important places and objects;
- Providing guidance on how to look after heritage items;
- supporting community heritage projects through funding and advice; and
- Maintaining the NSW Heritage Database, an online list of all statutory heritage items in NSW

The 1996 NSW Heritage Manual, published by the NSW Heritage Division (then under the name of Department of Urban Affairs and Planning), provides guidelines for conducting assessments of heritage significance.

Section 57 of the *Heritage Act 1977* makes it an offence to demolish, damage, despoil, move, excavate, develop, alter, place signage or damage/destroy any vegetation in the curtilage of an item on the State Heritage Register without a valid permit. There is a series of gazetted exemptions to this law (see Appendix A), which relate to minor works and works that will not impact on the significance of an item of State heritage. A permit under s60 is required for all other works. The proposal does not fall within the standard exemptions and will therefore require a permit under s60 of the *Heritage Act 1977*.

State Environmental Planning Policy (Western Sydney Parklands) 2009

Much of the proposal area (with the exception of small area in the centre) is governed by the State Environmental Planning Policy (SEPP) (Western Sydney Parklands) 2009 this planning policy. The Horsley Drive marks the boundary between Precinct 9 (“Horsley Park”) and Precinct 10 (“Abbotsbury”). The aim of this SEPP is to put planning controls in place to enable the Western Sydney Parklands Trust to develop the Western Sydney Parklands “into a multi-use urban parkland for the region of Western Sydney” (cl 2).

In reference to heritage matters, clause 15 states a general objective to conserve the heritage significance of items within the Western Sydney Parklands. Development consent is therefore required before any proposal can proceed and should include consultation with the Western Sydney Parklands Trust. Assessment of any proposal’s impact on the significance of any heritage items within the Western Sydney Parklands must be undertaken before development consent can be given.
The Bunya Pine identified in Section 2.8 below is within the Proposal Area, however it is assessed (see Section 6 below) that it will not be impacted by the Proposal. Recommendation 6 of this assessment also provides for its protection during construction works. Consent is therefore not required for this item.

It is noted further that continuous consultation with Western Parklands Trust has been undertaken by Roads and Maritime in relation to this Proposal.

**Western Sydney Parklands Trust**

In addition to the SEPP, the Western Sydney Parklands Trust has developed the *Western Sydney Parklands Plan of Management 2020* (2010) (PoM) which sets out a number of objectives and principles of land management within the parkland precinct. Objective 6 of the “Environment and Conservation” section notes the Trust’s commitment to protecting and enhancing the Parkland’s indigenous and non Indigenous cultural heritage. A supplement to the PoM was released in 2014, reflecting changes to both the PoM and the Parklands area since its initial release in 2010. One of these changes in the Proposal Area distinguishes the original Precinct 9 (renamed Horsley West) and a new section now known as Horsley Park, which now focuses on the corner of The Horsley Drive and Cowpasture Road.

Development and management principles for Precinct 9 state a commitment to “Plan for the impacts of future service infrastructure expansions in the Precinct” (NSW Government 2011:62). No particular reference to heritage is made for this Precinct. In 2012 a Masterplan for the Horsley Park precinct was released, with a focus on urban farming (see Plate 3).

However, under Precinct 10 (“Abbotsbury”), one of the Key Management Priorities is to “Explore the Indigenous and Non Indigenous heritage values and opportunities in this Precinct” (NSW Government 2011:64). The Trust is also commencing Stage 1 of the “Abbotsbury Precinct Track Connections” project, due for construction between April-June 2016 (http://www.westernsydneyparklands.com.au/about-us/parklands-projects/).
Plate 2 Masterplan of Horsley Park Precinct of the Western Sydney Parklands (NSW Government 2012: viii)
The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013

The Burra Charter is a set of best practice principles and procedures for heritage conservation. It was developed by Australia ICOMOS (International Council for Monuments and Sites), the Australian group of the international professional organisation for conservation. Although without statutory weight, the Burra Charter underpins heritage management in New South Wales and Australia. The policies and guidelines of the Heritage Council of NSW and the NSW Heritage Office are consistent with and guided by the Burra Charter.

Water NSW Act 2014 and Water NSW Regulation 2013

The purpose of this legislation was to the State Water Corporation (which became Water NSW), to abolish the Sydney Catchment Authority and to transfer its powers to Water NSW. Water NSW (formerly the Sydney Catchment Authority), is the registered owner of the Upper Canal System.

Sections 54 and 55 of the Water NSW Act 2014 provides for the management by Water NSW of controlled areas. These areas are administered by the Water NSW Regulation 2013. Schedule 1 of that Regulation defines “controlled areas” as:

Controlled areas

All Water NSW land on or in which there are any one or more of the following:

(a) Water transfer structures (being canals, tunnels, pipelines, water mains or drainage channels),
(b) Roads,
(c) A device that is used to monitor water and infrastructure associated with that device”

This would indicate that the canal, as well as being a heritage item owned by Water NSW, is a controlled area within the meaning of both the Water NSW Act 2014 and the Water NSW Regulation 2013. Consent from that organisation is required to undertake any development within their controlled areas (Water NSW Regulation 2013, cl 9). Clause 9 (3) states that:

“A consent granted by a body other than Water NSW, including a consent granted by Sydney Water Corporation, is not, for the purposes of this Regulation, to be taken as the consent of Water NSW.”

Consent for any development must be in writing (Water NSW Regulation 2013, cl 10).

In relation to heritage matters specifically, any Section 60 permit must be authorised by the owner of the heritage item. There is a section within the application form that provides for the owner’s signature and/or seal, confirming that they consent to the Proposal.

It is noted that Roads and Maritime have been in regular consultation with Water NSW as a part of this proposal.

2.2 NSW Heritage Registers Review

Acknowledged heritage items and places are recorded in statutory and non-statutory registers held at the Federal, State and local level depending on their level of significance. Internationally significant sites of ‘outstanding universal value’ are inscribed in the World Heritage List (WHL) and in turn, such sites are usually recognised through their inclusion on Federal and state-level registers.
Federal designations include the National Heritage List (NHL) and the Commonwealth Heritage List (CHL) created by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Both registers are maintained by the Commonwealth Department of the Environment and are available to view on an online database, the Australian Heritage Database. The NHL includes natural, historic and Indigenous places that are of outstanding national heritage value to the Australian nation. The CHL protects natural, Indigenous and historic heritage places on land owned or leased by the Commonwealth or a Commonwealth Authority. To reach the threshold for the NHL, a place must have ‘outstanding’ heritage value to the nation whereas to be entered on the CHL, a place must have ‘significant’ heritage value.

Heritage places of state significance are included on the State Heritage Register (SHR) maintained by the Heritage Branch. Places included on the SHR are available on an online database, the NSW Heritage Inventory database; however, it should be noted that the inventory includes items of state and local significance in NSW, it may not necessarily be comprehensive and inclusion on the inventory does not carry statutory weight in its own right. In order to reach the threshold for inclusion in the SHR, a place needs to meet one of more of the heritage criteria identified by the Heritage Council of NSW. The ultimate decision on whether a place is included on the State Heritage Register is made by the Minister for Heritage.

Places of local significance are included in heritage schedules in Local Environmental Plans (LEPs).

2.3 World Heritage

A search of the Australian Heritage Database on 12 April 2016 shows that there are no World Heritage Sites (‘WHS’) located within or near the Proposal Area.

2.4 National and Commonwealth Heritage

A search of the Australian Heritage Database undertaken on 12 April 2016 indicates that there are no items within or near the Proposal Area included on the NHL or CHL.

2.5 State Heritage

A search of the State Heritage Inventory database on 12 April 2016 found one item included on the SHR within the Proposal Area (see Table 2). Westons Tunnel a 19th century brick-lined tunnel running beneath The Horsley Drive and is part of the Upper Canal System, and therefore captured by the State heritage protection under the Heritage Act 1977 (see Plate 2 for their locations)

Table 2 Items of State Significance on the SHR

<table>
<thead>
<tr>
<th>Item</th>
<th>Address</th>
<th>Heritage Listing</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)</td>
<td>Prospect, NSW</td>
<td>01373</td>
<td>State</td>
</tr>
</tbody>
</table>

The other State heritage item is located outside the Proposal Area, being “The Horsley Complex”. Its primary address is at Jamieson Close, Horsley Park, 1.2 kilometres west of the eastern end of the Proposal Area. It is mentioned here as it has some bearing on the historical context of the area; The Horsley Drive roughly follows the alignment of the former carriageway from Cowpasture Road to the Horsley homestead. However the structures and curtilage of that item will not be impacted either directly or indirectly by the Proposal.
2.6 Section 170 Registers

Section 170 of the Heritage Act 1977 requires State Government Agencies to keep records of heritage items owned or operated by it. These registers can be found on the State Heritage Inventory. A search of this inventory was carried out on 12 April 2016 and one item was identified as being located within the proposal area (refer to Table 3 below).

Table 3 Items on s170 Heritage Registers in the study area

<table>
<thead>
<tr>
<th>Item</th>
<th>Address</th>
<th>State Government Agency</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)</td>
<td>Prospect, NSW</td>
<td>Sydney Water Catchment Authority (now Water NSW)</td>
<td>State</td>
</tr>
</tbody>
</table>

2.7 Local Heritage

A search of Schedule 5 of Fairfield LEP 2013 identified no items of local heritage within or in the vicinity of the proposal area.

2.8 Other heritage

In addition to the above, one further heritage item is listed on the SEPP (Western Sydney Parklands) as a heritage item:

Table 4 Other statutorily listed heritage items

<table>
<thead>
<tr>
<th>Item</th>
<th>Address</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bunya Pine</td>
<td>North western corner of The Horsley Drive and Cowpasture Road, Wetherill Park</td>
<td>Local</td>
</tr>
</tbody>
</table>
The Horsley Drive Upgrade

Figure 2: Historical Items in Study Area

Legend
- Red: Study Area
- Blue: Upper Canal System
- Green: Marker Tree

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping,panchromatic, Iscan, IGP, swisstopo, and the GIS User Community

NOTES:
Aerial Imagery by Esri online

PREPARED FOR: SPG
CHECKED BY/DATE: MD/12-08-2016
APPROVED BY/DATE: GJ/12-11-2016

GIS REF: 130033 Figure2 Horsley Drive Upgrade A A4 20160713
Aerial Imagery by Esri online
3 Historical Context

In order to understand the significance of any heritage items or potential for heritage items in the Proposal Area, it is first necessary to conduct a brief review of historical sources relating to both the broader area and the particular Proposal Area. This section deals with the events that took place in the area and the people who used it, thus illuminating what may be still present.

3.1 Broad Historical Context

The earliest known European to explore the Prospect area was Captain Arthur Philip, who explored the area in April 1788. He described the view from a hill as “so beautiful that I called the hill Bellevue” (Library Committee of the Commonwealth Parliament 1914:133-134). However, there is some conjecture that this hill was Prospect Hill and not some other hill. Later commentators have inferred that the hill was Prospect Hill.

Plate 3 Map by Lieutenant-Governor and Deputy Judge Advocate David Collins, c 1798, showing location of Prospect Hill in relation to the Proposal Area (Collins 1798).
Captain Watkin Tench also describes climbing the Hill in 1789, which he is credited with naming as “Prospect Hill”. Phillip Gidley King describes walking with Governor Philip to Prospect Hill in 1790:

“After dinner, I accompanied the governor from Rose-Hill to Prospect-Hill, which is about four miles distant: we walked through a very pleasant tract of country, which, from the distance the trees grew from each other, and the gentle hills and dales, and rising slopes covered with grass, appeared like a vast park. The soil from Rose-Hill to Prospect-Hill is nearly alike, being a loam and clay. It is remarkable, that although the distance between the two places is only four miles, yet the natives divide it into eight different districts.” (Hunter 1793 [1968]).

As the famous Wongal man Benelong was Governor Philip’s Aboriginal guide and companion, as well as being Philip’s tutor on Aboriginal matters at the time, it is likely that King learned of the natives’ eight different districts from him.

Philip also noted the soil was of good quality for farming, something that had eluded them in the infant colony at Sydney. He therefore began granting land to emancipated convicts in the area of Prospect-Hill. This of course led to fighting between the native inhabitants and the incoming settlers, which lasted until after the death of Pemulwuy in 1802, an Aboriginal warrior active in guerrilla warfare in the Prospect and Parramatta area.

3.2 Horsley Estate

One early landowner in the Prospect area was Lieutenant Colonel George Johnston of Annandale Farm, who was granted 2000 acres in the Prospect area by Governor King, with the current Proposal Area being located entirely within this grant. The grant was a reward to Lt Col. Johnston for his role in quelling the convict uprising at Castle Hill in 1804. It is not known whether Johnston ever lived on the property, but he did name it “King’s Gift” in gratitude to Governor King. The eastern boundary of the grant was formed by today’s Cowpasture Road, with government land to the north, and Major Edward Abbott’s grant to the south (“Abbotsbury”).

Following Johnson’s death in 1823 the land was inherited by his daughter, Blanche, who married Captain George Edward Nicholas Weston in 1829. Captain Weston’s brother, William Francis Weston owned another property in Dapto named “Horsley” in around 1819. William died in 1826, at which time Captain Weston travelled to Australia and assisted William’s widow. Both places were named after West Horsley Manor in Surrey, United Kingdom, the seat of the Weston family.
After their return from a trip to India, Captain and Mrs Weston began building “Horsley Park”. It was completed in 1832 and comprised the homestead, detached kitchen, stables, a blacksmith’s shop and barn. According to the artist Hardy Wilson, writing in 1920, the house resembled a small village and in design was based very much on the Indian style bungalows:

“At the edge of the plateau where the path ascends, there are two Moreton Bay figs intermingled with sweet-bays forming an entrance archway through which the homestead appears half-submerged in formal shrubs and tall waving grasses. The front has an attractive verandah. There are coupled Doric columns, dark Jhilmils with folding white casements between, and round-arched bays at the ends. Within there is a punkah hanging idly from the lofty ceiling, a mark of past luxuriousness. There are high double doors glistening under white paint and polished brasses.” (Wilson 1920:9).

A carriageway originally led from the old Cowpasture Road westward to the current tree-lined carriageway, which then ascended the hill to the homestead. Horsley Drive follows the alignment of this original carriageway (Edward Higginbotham and Associates 1997:18).
Plate 5 “Horsley Park” Complex showing carriageway (Courtesy Six Viewer and RPS, 2015).

Plate 6 “Horsley Park” homestead, undated (Courtesy Kathy Curran, Royal Australian Historical Society Librarian, C/- Fairfield Museum and Gallery).
Plate 7 Outbuildings of “Horsley Park” complex, undated (Courtesy Kathy Curran, Royal Australian Historical Society Librarian, C/- Fairfield Museum and Gallery).

According to Wilson, however, the greatest treasure on Horsley was not the homestead, but a carriage that at the time of Wilson’s visit was still stored in one of Horsley’s outbuildings:

“It is the oldest vehicle in Australia, a four-wheeled carriage, a thing of graceful curves, and ironwork in the Neo-Greek style. A thousand times and more it must have rolled along the Cow Pasture Road, creaking up inclines and thundering down again over the hills that lie like peaceful waves on a petrified ocean between Horsley and the turn-off to Liverpool” (Wilson 1920:10).

This carriage was mentioned in a local newspaper article in 1939. The article stated that the “Horsley buggy”, stored in a great stone shed which was once used to lock up the convicts who built the house, was “built in 1810 by Urquhart, one of the first Sydney coach builders” (The Biz (Fairfield NSW: 1928-1972) 1939:2).

The Horsley Estate remained with the Westons until 1904, when Blanche Weston, Johnston’s daughter, died (Captain Weston passed away in 1856). It then passed to Weston descendants, including Edward Henry Weston, Blanch Eliza McDougall, Representatives of Robert Weston McDougall, Trustees of Frederick Weston, Representatives of Francis Jenkins Weston and the Perry family. By 1924 the entire estate passed out of the ownership of the Weston family to Sydney Gordon Vicars, who planned to subdivide the eastern portion of the Estate, including the current Proposal Area.

In 1928 Vicars transferred the eastern portions of the Horsley Estate to Arthur Rickard & Co Ltd, who commenced the planned subdivisions. These subdivisions were much smaller blocks, suitable for poultry, orcharding, market gardening and light grazing, ranging between 2 acres to 15 acres (see Plate 9).
3.3 The Horsley Drive

It was around the time of subdivision that The Horsley Drive transitioned from a carriageway to a road. A necessary access to many of the subdivided blocks, newspapers from the time appear to indicate that the road was formed by volunteer labour, most likely those most affected by its condition. An article from the local newspaper, “The Biz”, reports:

“The second day of voluntary work (on Monday last) saw another 14 chains of Horsley-Road shaped into good condition. Not such a great number of workers turned out this time, as the work was all done by horse teams; but next Monday every settler will turn out, and it is expected to finish off a section of almost 2 miles.” (The Biz (Fairfield 1931:4).

The poor condition of the roads in the Horsley Park area continued to be a common complaint by settlers to the area in the 1920s and 1930s. In 1934 Fairfield Council carried a motion to repair The Horsley Drive (then known as Horsley Road) and other roads in which the bus operated with blue metal and bush metal on other roads. This was done in response to criticism of the roads’ condition (The Biz (Fairfield 1934:5). Again in 1939, 26 settlers petitioned the Council to repair the roads, which were unusable after wet weather (The Biz (Fairfield 1939:4).
3.4 Wallgrove Road

This road was named after a Second World War army camp located on the corner of Wallgrove Road and the M4 motorway, which was for a time in the 1980s and 1990s the site of an amusement park known as “Australia’s Wonderland”. The army camp was itself named after the property “Wall’s Grove”, built by Colonel Charles William Wall, who came into possession of the same land in 1827.

In 1929 a petition was presented to the Main Roads Board requesting:

“…a main road from Fairfield right through Smithfield to Rooty Hill Railway Station and through Horsley Estate… There is a rough road from here (Fairfield) to Rooty Hill and room for many thousands of our population to settle down. This road would make an outlet to both railway stations by the southern and western lines for our products.” (The Biz (Fairfield NSW: 1928-1972) 1929:1).

The description of this road matches the current alignment of Wallgrove Road. The current Wallgrove Road runs from Elizabeth Drive, Cecil Hills in the south to Rooty Hill station in the north. It passes through the former Horsley Estate. The date of the above article also tallies with other information that the Horsley Estate was not broken up until 1928. Old Wallgrove Road commenced to the west of Horsley Estate, with the new alignment cutting through the estate.

In 1940 a new army camp was established at Wallgrove, roughly on the south east of the Wallgrove Road and M4 Motorway intersection (known as the “Light Horse Interchange”). As indicated by the name of the interchange, Wallgrove Army Camp was home to the 21st Light Horse Regiment as well as a number of Infantry Battalions and anti-aircraft regiments. The camp was primarily used as a staging and training area during the Second World War.

In 1942 a parcel of land within the Horsley Estate was resumed by the Commissioner for Main Roads. An internal publication by the Department of Main Roads from 1946 states that a link was created between Liverpool and the old Wallgrove Road in order to facilitate troops and defence supplies, as well as the construction of Wallgrove Aerodrome (now located on the former OTC land, north of the Great Western Highway at Rooty Hill) (Department of Main Roads 1946:58-59).

Wallgrove Road has been realigned and widened in the intervening years. The M7 Westlink now roughly follows the alignment of Wallgrove Road from the intersection with Elizabeth Drive to the M4 Motorway.

3.5 Cowpasture Road

The Old Cowpasture Road is one of the oldest roads in the area. It originally linked Prospect to Camden. The area around Camden was known as “The Cowpastures” after a herd of cows that had arrived on the First Fleet escaped from the fledgling colony and made their way across the Nepean River. They were found near Camden seven years later and in much greater numbers. In order to protect the herd, land grants in “the Cowpastures” were forbidden.

The road was initially a track made by early gentlemen visitors wishing to see the land and the cattle. In 1805 James Meehan surveyed the route between Prospect and the Nepean River Crossing near Camden. A rough road eventually was made, and is now known as Cowpasture Road and Camden Valley Way (Wrigley 2001).
3.6 Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)

Following the exhaustion and failure of three previous water systems to provide drinking water for Sydney, being the Tank Stream, Busby’s Bore and the Botany (Lachlan) swamps, the Governor of NSW appointed a commission in 1867 to investigate and recommend a safe and reliable system. The commission settled on the Upper Nepean Scheme, which comprised two diversion weirs at Pheasants Nest and Broughton Pass using the Upper Nepean River. Water would be gravity fed through a series of tunnels, canals and aqueducts through to Prospect Reservoir, which was commenced construction in 1880 and completed in 1888 (see Plate 10). Both the reservoir and Upper Nepean Scheme was designed and constructed by the Public Works Department NSW.

Plate 9 Detail from Crown Plan 288-3000 showing Weston’s Tunnel section of the Upper Canal System (Sheet 11) (Courtesy Land & Property Information NSW).

The fabric of the canal varies throughout its length, dependent on the landscapes it passes through. In soft landscapes the canal is trapezoidal in shape and lined with reinforced concrete slabs. In areas where the land is less soft, the canal is U-shaped and lined with sandstone masonry (Water NSW Undated). The lengths of canal north (outlet) and south (inlet) of The Horsley Drive are U-shaped but with concrete rendering along the open canal sections (see Plate 11). The fabric beneath the concrete render is unknown. Near the inlet to Weston’s Tunnel the fabric changes from concrete render to ashlar sandstone blocks (see Plate 15) whilst the interior of the tunnel is lined with brick (see Plates 15, 20 and 21).

The Upper Canal System commenced operation in 1888 and has been in operation since that time. Apart from augmentation and development in supply and other improvements, the Upper Canal and Prospect Reservoir has not changed a great deal since that time (B Cubed Sustainability 2005).
The Weston Tunnel was constructed in the late 19th century as part of the Upper Canal System. The Weston Tunnel section of the Upper Canal System measures approximately 134 metres long and runs in a roughly north-south direction beneath The Horsley Drive. It is a horse-shoe shaped tunnel constructed of brick, measuring internally at 2.85 metres wide and 2.4 metres high. The obvert is approximately 7.4 metres below the current surface of The Horsley Drive. An inspection by AECOM in 2015 states that the tunnel was formed by the “drill and blast technique through Wianamatta Shales in the late 1890s and it is lined by three courses of brick” (AECOM 2015:2).

Plate 10 Upper Canal System, looking south (RPS, 2016).
4 Visual Inspection

A visual inspection of the Proposal Area was made on 13 April 2016. The visual inspection took in the general physical context of the Proposal Area and the heritage items:

- Within the Proposal Area; and
- In the vicinity of the Proposal Area.

4.1 General Physical Context

The Proposal Area comprises the road corridor of the Horsley Drive between Cowpasture Road in the east and the M7 motorway in the west. It also encompasses the area for construction vehicle movement, realignment areas, compound sites and related areas. The land north and south of The Horsley Drive is currently semi rural in nature, with paddocks used for grazing and market gardening. Also, to the south of The Horsley Drive (east) is the Western Sydney Parklands and (west) the Sydney Equestrian Centre.

In the western portion of the Proposal Area Eastern Creek bisects the Horsley Drive in a roughly north-south direction. A number of smaller water courses, both permanent and ephemeral, were also noted throughout the Proposal Area. Aside from the banks of Eastern Creek, vegetation has been cleared leaving open pasture.

Plate 11 The Horsley Drive near Ferrers Road, looking east (RPS, 2016).
The summit of a moderately steep hill is located near the intersection of The Horsley Drive and Ferrers Road, with the eastern portion of the Proposal Area sloping away from it to the east, and the western portion of the Proposal Area sloping away from it to the west.

Plate 12 Regional views from The Horsley Drive near the crossing of the Upper Prospect Canal, looking north (RPS, 2016).

Disturbances to the Proposal Area include vegetation clearance and the construction of dams, roads, footpaths, housing and other infrastructure.

4.2 Heritage Items within the Proposal Area

There are two items located within the Proposal Area, being the Upper Canal System (Pheasants Nest Weir to Prospect Reservoir) (State heritage listed) and the Bunya Pine (local listing). The Upper Canal System bisects The Horsley Drive approximately 500 metres to the north-west of the intersection with Cowpasture Road and runs in a roughly north-south alignment. The Bunya Pine is located on the north western corner of Cowpasture Road and The Horsley Drive.

The Upper Canal System feeds into Prospect Reservoir approximately two kilometres to the north of the Proposal Area. As noted above the fabric of the Upper Canal System varies along its length, however in most places along its alignment within the Proposal Area it comprises a concrete rendered water canal. A pedestrian/cycle path is located along the canal and within the curtilage.
Within the curtilage of the Upper Canal System are two crepe myrtle trees and four gate posts. The crepe myrtles are located on the southern side of the Horsley Drive near the southern portal of Weston’s Tunnel. The gate posts were also connected with a homestead, and they are located along the northern side of The Horsley Drive. The gate posts are concrete and mark the entrance to an access track to the Upper Canal System to the north of the Horsley Drive. The Inventory Sheet No. 44 from the Conservation Management Plan for the Upper Canal states that both the crepe myrtles and the concrete reinforced gate posts were once associated with a former cottage site and were assessed to be of considerable significance (Edward Higginbotham & Associates Pty Ltd 2001).

The curtilage of the Upper Canal System varies along its length and also varies within the Proposal Area itself. The curtilage surrounding Weston’s Tunnel and the Horsley Drive Crossing is approximately 80 metres wide, whereas the width of the curtilage north and south of Weston’s Tunnel drops to approximately 50-60 metres across. The curtilage is fenced on both sides. The canal is mostly open, however immediately north and south of The Horsley Drive at the entrance and exit of Weston’s Tunnel the water canal is covered over. The curtilage continues beneath The Horsley Drive with Weston’s Tunnel, however the overlaying road corridor is not part of the curtilage. Prospect Hill is visible to the north from the point where the canal crosses The Horsley Drive.

Weston’s Tunnel is part of the Upper Canal System and runs directly beneath The Horsley Drive. It is a 19th century brick-lined, U-shaped tunnel running for approximately 134 metres as part of the Upper Canal System (AECOM 2015:2).

Plate 13 Upper Canal System, south of The Horsley Drive, looking south. The curtilage of the item includes the mown areas shown above (RPS, 2016).
Plate 14 Grated inlet of Weston's Tunnel section of Upper Canal System, looking east. The Horsley Drive is located just outside of frame at the top of the rise to the left. Note ashlar blocks (RPS, 2016).

Plate 15 Weston's Tunnel outlet, looking south (Courtesy AECOM, 2015:4).
Plate 16 Above the grated inlet to Weston’s Tunnel. Note nameplate (RPS, 2016).

Plate 17 Grate at the inlet at the southern end of Weston’s tunnel leading from the main canal of the Upper Canal System, looking south (Courtesy AECOM, 2015:6).
Plate 18 Inlet of Weston's Tunnel, looking north west (AECOM, 2015:5).
Plate 19 Detail of brickwork on the interior of Weston’s Tunnel (AECOM, 2015:5).

Plate 20 The Horsley Drive current crossing of Upper Canal System looking south west. The fencing marks the curtilage of the Upper Canal System (Courtesy Google Earth).
As noted in Section 3.2 above, The Horsley Drive was the former carriageway for the Horsley homestead, and the Estate fronted onto Wallgrove Road. The Bunya Pine is likely to be a marker tree for the entrance of the carriageway to the homestead. As with other homesteads of the era, there may have been other trees around the entrance that are no longer present.
4.3 Heritage Item within the Vicinity of the Proposal Area

As noted in Section 2.5 above, the heritage item, the Horsley Complex, is well outside the Proposal Area, however the Proposal Area was once part of that land grant. Indeed, the Horsley Drive follows the alignment of the carriageway to the house from Cowpasture Road and the Bunya Pine marks the entrance.
4.4 Archaeological potential

As shown in Figures 1 and 2 above, the Proposal Area mostly comprises the current and new road corridor of The Horsley Drive and other areas such as construction vehicle and site offices. As noted above, the alignment of The Horsley Drive largely follows the alignment of the carriageway to Horsley Park homestead. Therefore the most likely archaeological remains would be surfaces related to that carriageway. It is possible that other remains would be related to previous agricultural properties that appeared following the break-up of the Horsley Park estate after 1928, however as these were mostly in the form of poultry and small agricultural crops with few buildings, it is unlikely that much would be left in the landscape from these activities. It is also unlikely that any of these types of archaeological material will satisfy the meaning of a “relic” as per the Heritage Act 1977. Nonetheless, if uncovered these should be inspected by a qualified archaeologist to determine their significance and management.

In any case, disturbances through previous road construction, grading, upgrade and resurfacing as well as maintenance works are likely to have removed archaeological deposits of non Aboriginal significance from within the road corridor. The archaeological potential for non Aboriginal deposits is therefore assessed as low-nil.

The significance of the Upper Canal System (Pheasants Nest Weir to Prospect Reservoir) means that any archaeological deposits in its vicinity must be treated with caution and care, particularly any deposits relating to the construction of the canal. Given the limited development within the curtilage of the canal it raises the potential for these undisturbed deposits. As noted in Section 4.2 above, a cottage once existed within the curtilage, which was used by Water Board employees charged with the maintenance of the canal. The cottage has since been cleared, with the only physical remains being a stand of crepe myrtle trees to the south of The Horsley Drive and four reinforced concrete gate posts to the north of The Horsley Drive. Depending on the construction of this cottage, it is possible that the substrata of the cottage will remain, however it is considered unlikely that it will yield material that will meet the threshold of significance for archaeological deposits. Nonetheless, should these or any other archaeological remains be uncovered during works, including but not limited to those within the curtilage of the Upper Canal System, they should be inspected by a qualified archaeologist to determine their significance and management.
5 Heritage Significance Assessment

In line with the *Burra Charter*, before making decisions about the future of a heritage item it is first necessary to understand its heritage significance and the values it embodies. The following section contains an assessment of the heritage significance of the Upper Canal System using the NSW State heritage significance criteria explained in *Assessing Heritage Significance* (Heritage Office (former), 2001). Consideration is also given to the integrity and intactness of the item(s).

The aim of the significance assessment is to examine the heritage values embodied by the item(s) to form a baseline from which the impact on that significance as a result of the proposal can be measured.

There are two heritage items recorded within the footprint of the Proposal Area. The significance and heritage values of both of these items will be assessed in this section.

5.1 Historical Themes in Evidence

National and state-level patterns of historical development are useful in determining the historical value of a site. Nine historical themes have been developed and adopted by NSW Heritage Council. They are derived from the Australian historical themes prepared by the Australian Heritage Commission. The following table notes the NSW historical themes considered to be in evidence in the Proposal Area.

**Table 5 NSW Historical Themes Considered to be in Evidence**

<table>
<thead>
<tr>
<th>Australian Theme</th>
<th>NSW Theme</th>
<th>Local theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Developing local, regional and national economies</td>
<td>Environment – cultural landscape</td>
<td>Activities associated with the interactions between humans, human societies and the shaping of their physical surroundings</td>
</tr>
<tr>
<td>4. Settlement – Building settlements, towns and cities</td>
<td>Utilities – Activities associated with the provision of services, especially on a communal basis</td>
<td>Providing drinking water</td>
</tr>
<tr>
<td>7. Governing - Governing</td>
<td>Government and Administration – Activities associated with the governance of local areas, regions, the State and the Nation, and the administration of public programs – including both principled and corrupt activities</td>
<td>Building and operating public infrastructure</td>
</tr>
<tr>
<td>7. Governing - Governing</td>
<td>Government and Administration – Activities associated with the governance of local areas, regions, the State and the Nation, and the administration of public programs – including both principled and corrupt activities</td>
<td>Developing roles for government – providing reticulated water</td>
</tr>
<tr>
<td>7. Governing - Governing</td>
<td>Government and Administration – Activities associated with the governance of local areas, regions, the State and the Nation, and the administration of public programs – including both principled and corrupt activities</td>
<td>Developing roles for government – public water supply</td>
</tr>
</tbody>
</table>
5.2 Significance Assessment

The following significance assessment uses the NSW State Significance Criteria as set out in ‘Assessing Heritage Significance’ (former Heritage Office, 2001). The heritage significance of the Upper Canal System and Bunya Pine are assessed as follows:

**Upper Canal System (Pheasants Nest Weir to Prospect Reservoir) (“Upper Canal System”)**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Significance assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Historic:</strong> An item is important in the course or pattern of NSWs cultural history (or the cultural or natural history of the local area).</td>
<td>The Upper Canal System and Prospect Reservoir is historically significant being the first successful long term reticulated water system for Sydney. It was also the first reticulated water system that harvested water from upland catchment areas rather than local sources. The Weston Tunnel portion of the canal was built in 1898 and is one of the earlier constructed sections. The crepe myrtle trees on the southern side of The Horsley Drive and the concrete gate posts on the northern side of The Horsley Drive are associated with a former cottage site that was once occupied by Water NSW workers who maintained that section of the Canal. The cottage is no longer standing; the trees and gate posts are its last physical remains.</td>
</tr>
<tr>
<td><strong>Associative:</strong> An item has strong or special associations with the life or works of a person or group of persons of importance in NSWs cultural or natural history.</td>
<td>The Upper Canal System was designed by engineer-in-chief Edwin Orpen Moriarty, who also designed other high profile water and drainage works such as Morts Dock at Balmain, Sutherland Dock on Cockatoo Island, the first Pyrmont Bridge, Newcastle Harbour and the Upper Nepean Water Supply Scheme. His overall involvement in the design of this and other State schemes and this canal system translates to a high associative significance high at a State level.</td>
</tr>
<tr>
<td><strong>Aesthetic:</strong> An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement.</td>
<td>The Upper Canal System was part of the first system delivering a reticulated water system from the Upper Nepean River to Sydney. This involved the construction of a number of canals, tunnels and aqueducts as well as the Prospect Reservoir, then the water delivery pipes from Prospect Reservoir. It was constructed prior to the advent of reinforced concrete construction and is therefore technologically significant.</td>
</tr>
<tr>
<td><strong>Social:</strong> An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Research potential:</strong> An item has the potential to yield information that will contribute to an understanding of NSWs cultural or natural history.</td>
<td>There is some research potential attached to the construction and engineering methods used. Many of the original controls are still in use today and are illustrative of 19th century engineering and construction.</td>
</tr>
<tr>
<td><strong>Rarity:</strong> An item possesses uncommon, rare or endangered aspects of NSWs cultural or natural history (or the cultural or natural history of the local area).</td>
<td>The Upper Nepean Scheme is unique to NSW and therefore is considered rare.</td>
</tr>
<tr>
<td><strong>Representativeness:</strong> An item is important in demonstrating the principal characteristics of a class of NSWs (or the local areas) cultural or natural places, or cultural or natural environments.</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
Integrity

The integrity of the Upper Canal System is excellent. It is still a working pipeline for the Sydney water supply and therefore is in excellent condition and largely intact. Much of the original fabric is still in situ, particularly in the Weston Tunnel, with only a small amount of visible modern upgrades, in the form of fencing, modern piping and patching of the masonry where required. A Condition Assessment undertaken in 2015 on behalf of Roads and Maritime found that the Weston Tunnel was in reasonable condition (AECOM 2015).

Statement of Heritage Significance

The Upper Canal System as part of the Upper Nepean Scheme is historically, associatively, technically and scientifically significant as well as being rare. Many features of the existing Upper Canal System are original, although augmented with modern supporting material to extend the life of the canal. It is considered to be of State significance and is registered on the State Heritage Register.

Plate 23 Upper Canal System, looking north towards the Horsley Drive (RPS, 2016).
Bunya Pine

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Significance assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Historic:</strong> An item is important in the course or pattern of NSWs cultural history (or the cultural or natural history of the local area).</td>
<td>The bunya pine is historically significant as it provides a marker to the former entrance to the Horsley Estate. As noted above, The Horsley Drive was formerly the carriageway leading from Cowpasture Road to the homestead, so the bunya pine (most likely with other pines or other trees) provided a visual marker to that entrance.</td>
</tr>
<tr>
<td><strong>Associative:</strong> An item has strong or special associations with the life or works of a person or group of persons of importance in NSWs cultural or natural history.</td>
<td>The bunya pine is associated with the Weston family who owned the Horsley Estate from the early 19th century through to 1904. It also provides a physical reminder of the former size of the estate, with the pine located approximately 2.8 kilometres from the nearest boundary of the current “Horsley” complex.</td>
</tr>
<tr>
<td><strong>Aesthetic:</strong> An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement.</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Social:</strong> An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Research potential:</strong> An item has the potential to yield information that will contribute to an understanding of NSWs cultural or natural history.</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Rarity:</strong> An item possesses uncommon, rare or endangered aspects of NSWs cultural or natural history (or the cultural or natural history of the local area).</td>
<td>The bunya pine, being the last physical evidence attached to the original Horsley Estate outside of the current Horsley complex is considered to be rare.</td>
</tr>
<tr>
<td><strong>Representativeness:</strong> An item is important in demonstrating the principal characteristics of a class of NSWs (or the local areas) cultural or natural places, or cultural or natural environments.</td>
<td>It is representative of other marker trees for homesteads and estates.</td>
</tr>
</tbody>
</table>

**Integrity**

The tree appears to be in good condition. To establish the tree’s health, however, a qualified arborist would need to be consulted.

**Statement of Significance**

The bunya pine is considered to be historically and associatively significant, as well as being a rare piece of evidence outside of the current Horsley complex. Whilst bunya pines form many avenues and markers for 19th century homesteads, this bunya pine marks the entrance to one of the earliest existing dwellings in the local area and also illustrates the former magnitude of the original Horsley Estate. It is considered to be of local significance.
The only perceived constraint in relation to heritage relating to the Proposal involves the crossing of Upper Canal System at Weston’s Tunnel as part of the Horsley Drive upgrade. This section examines the options that have been considered in light of the heritage constraints and the assessment of a preferred option. This section also assesses the likely impacts on the heritage significance of the Upper Canal System (Pheasants Nest Weir to Prospect Reservoir) by the preferred option based on the final concept design.

6.1 Structures Concept Options

As noted above, The Horsley Drive crosses the Upper Canal System, which is State Heritage listed. In 2016 GHD prepared a Structures Concept Options Report as part of this Proposal examining various options of crossing the Upper Canal System and the expected heritage impacts of each of those options. The Structural Concept Options Report built on the Preliminary Options Report prepared by AECOM in 2015, which proposed six options:

Table 6 Options for crossing of Weston’s Tunnel (Upper Canal System) by AECOM, 2015 (AECOM in GHD 2016:4)

<table>
<thead>
<tr>
<th>Option</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fill to road level, no structure (base case)</td>
</tr>
<tr>
<td>2</td>
<td>Light weight fill to road level, no structure</td>
</tr>
<tr>
<td>3</td>
<td>Protection slab at existing surface level, fill to road level</td>
</tr>
<tr>
<td>4</td>
<td>Protection slab at existing surface level, no fill</td>
</tr>
<tr>
<td>5</td>
<td>Arch structure over tunnel, fill to road level</td>
</tr>
<tr>
<td>6</td>
<td>Bridge structure (Super T girders and in-situ deck) at proposed road level</td>
</tr>
</tbody>
</table>

GHD noted that the “vertical alignment at the tunnel location requires approximately 6 metres of fill” (GHD 2016:4).

In addition to the above options, GHD provided two further options:

Table 7 Additional options (GHD 2016:5)

<table>
<thead>
<tr>
<th>Option</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7A</td>
<td>Precast PSC plank structure at mid-level, fill to road level</td>
</tr>
<tr>
<td>7B</td>
<td>Precast Pre-Stressed Concrete plank structure at proposed road level</td>
</tr>
</tbody>
</table>

The eight options were assessed as part of the GHD Structures Concept Options Report.

6.2 Crossing of Upper Canal System – Options considered

It was assessed that of the eight options considered regarding the crossing over the Upper Canal System, most involved either an unacceptable level of harm to the Upper Canal System or were unworkable in terms of constructability (GHD, 2016). Of those eight options only two options were considered to be acceptable both from a heritage perspective and constructability (Options 3 and 7B). The remaining six items were rejected either on heritage grounds or for impractical constructability. Only Options 3 and 7B are analysed here.
Option 3 – Protection Slab at existing surface level; fill to road level

The vertical profile of the proposed road would be raised and would require a fill layer over the Westons Tunnel. The maximum height of fill would be about four metres at the tunnel. This fill would be on top of a concrete plank structure supported by piles either side of the tunnel. The bored piles could be relatively close to the edge of the tunnel lining at a minimum of 2 to 3 would accommodate a clearance of 2-3 metres from the tunnel structure. There may be some loading impact on the tunnel structure below, during construction or long term.

Option 7B – Precast Pre-Stressed Concrete plank structure at proposed road level

The crossing will comprise pre-stressed concrete planks of between 12 to 18 metres in length installed across the tunnel location. The plank structure will be approximately at the level of the proposed road, as such there will be a three metre tapering void below the plank structure, with no fill layer. The concrete plank structure would be supported by piles either side of the tunnel. The bored piles would accommodate a clearance of 5-7 metres from the tunnel structure. There may be some loading impact on the tunnel structure below, during construction.

Plate 24 Option 7B for Tunnel Crossing, plan view (Courtesy: GHD, 2016:12).

The design of both options avoids any direct impact to the Upper Canal System. Both are constructed with concrete slabs supported by piles, and both options avoid direct contact with Weston’s Tunnel. However Option 3 has a shorter slab, meaning that that the supporting piles will be slightly closer to the heritage item.
The proximity of the piles represents an elevated risk of harm to the item than those piles located further away.

As noted above, Option 7B suggests that there may be some loading impact during construction through vibration. The potential for this impact is highly dependent on the current condition of Weston’s Tunnel and its susceptibility to damage through vibration. A Condition Assessment of the Weston Tunnel was undertaken by AECOM in 2015, which found the tunnel in reasonable structural condition. However, the report notes that:

“A range of scenarios due to the road upgrade may result in changes to loading on the tunnel structure requiring further work in the form of investigations of the ground surrounding the tunnel and geotechnical/structural modelling and analysis to evaluate the various temporary and permanent load cases. The modelling would need to specifically consider the masonry structural form of the tunnel”

Load and vibration are the two impacts that may cause harm to the item. Methods of limiting this likelihood and/or extent of loading impact have been explored, and a methodology of boring for the piles has been established to minimise impact through the vibration (see Section 6.3 below). However, as Option 3 has its piles located closer to the item, the preferred option from a heritage point of view was Option 7B (GHD 2016:11).

6.3 Impact Assessment of Preferred Option - Assessment of Potential Impact of Tunnel Crossing on Physical Fabric, Attributes and Setting

Preferred Option Construction Description

The project involves the duplication of the existing road over the Water NSW Supply Canal (“Upper Canal System”) and the heritage listed Weston Tunnel east of the Ferrers Road intersection. The upgraded road will be carried over the heritage structure on a new single span bridge approximately 16m in length. The design of the bridge has been chosen to limit the vibration and construction impacts on both the canal and tunnel.

The superstructure of the bridge comprises a 200mm nominal thickness cast-in-place reinforced concrete deck supported on prestressed concrete planks 600 mm deep. The substructure comprises of (sic) cast-in-place reinforced concrete abutments supported on eight (8) 1,000 mm diameter reinforced concrete pier columns and 1,200 mm diameter bored cast in place reinforced concrete piles. The piles are located approximately 5 metres from each side of the Weston Tunnel to limit vibration during construction.

Construction of the bridge will be carried out in two (2) stages to suit the construction staging traffic arrangements (GHD 2017a).

The final concept design has contemplated the constructability of the new bridge structure to be built over the Upper Canal System/Westons Tunnel so as to protect the fabric of the heritage item. As depicted within the current bridge concept design drawing 2016/000627 (see Appendix B) the bridge is supported by end bearing reinforced concrete bored piles. These piles will support all loading of the road and bridge structure above and effectively transfers new loads to a load bearing soil stratum below the heritage tunnel. The bored piles are placed five metres clear of the tunnel to minimise impact during construction. Bored piles have been proposed as this type of pile has significantly less vibration impact compared to driven piles, thereby minimising any indirect impact.
During construction, the following additional measures will be undertaken to protect the heritage item:

- A temporary steel pipe would be provided to carry stormwater over the canal. Although not yet finalised, it is to be designed to prevent any load on the existing canal structure during construction.
- Vibration monitoring would be undertaken during construction in the vicinity of the heritage tunnel
- A pre- and post-dilapidation assessment report would be undertaken on Weston’s Tunnel and Upper Canal in the vicinity of the works.
- Consultation will be carried out with Water NSW during the detailed design phase.

Current condition of Weston’s Tunnel

A conditions assessment of Weston’s Tunnel was undertaken by AECOM in 2015 to assist in informing Roads and Maritime of the potential impacts of an upgrade of The Horsley Drive on the tunnel. It was observed that:

“...no major physical sign of movement of tunnel structure, such as differential settlement or displacement of the masonry, were observed. Only minor mortar loss or softening and some minor cracks on the bricks and joint openings were observed at some localised areas. No significant areas of water egress or moisture were observed on the tunnel side walls or obvert. No significant brick displacement was observed.” (AECOM 2015:7).

As a result of their investigation AECOM concluded that the tunnel was in reasonable condition and that the Year to End of Service Life (YESL) is significant. This signifies that the tunnel is in sufficiently good condition to withstanding at least the load transferred by the current fill overlaying the tunnel. AECOM qualify their statement by saying that quantifying the YESL is inappropriate as a preferred option had not been settled on at that time. (AECOM 2015:7). This attention to the potential loads combined with the Weston’s Tunnel’s amenability to change has been incorporated into the design of the preferred option through the provision of a void between the concrete plank and the tunnel, and the use of the bored piles to minimise damage through vibration during construction.

Impact on Remnant Plantings and Reinforced Concrete Gate Posts

As noted in Section 5.2 above, there is a stand of crepe myrtle trees located within the curtilage of the Upper Canal System to the south of The Horsley Drive, to the east of the Water NSW access track, and four reinforced concrete gate posts to the north of The Horsley Drive. The trees will be removed as part of the works however impact of the gate posts is uncertain at this stage. RMS has stated that every effort will be made to avoid any damage to the posts during the detailed design and construction phase of the proposal if feasible.

Aside from information received from Water NSW regarding their association with the former Water Board cottage site, little information exists regarding these items outside of the limited descriptions in the Inventory Sheets of the CMP (Edward Higginbotham & Associates, 2001). However, it is considered that they do not form a significant part of the fabric of Upper Canal System or this section of the Upper Canal System.

It is recommended therefore that these items are recorded as part of the archival recording required by Water NSW prior to the commencement of works.
Vibration

A Noise and Vibration Assessment was undertaken by GHD in February 2017 to assess the potential noise and vibration impacts of the operation and construction of the Proposal (GHD 2017:7). Section 4 of that report assesses the construction noise and vibration, including that of the construction of the Weston’s tunnel crossing.

In relation to vibration levels for heritage structures, GHD used the German Standard, *DIN 4150-3: 199 Structural Vibration – Part 3: Effects of vibration on structures*. The guideline values for short term vibration were given as:

**Table 8 Guideline values for short term vibration on structures (GHD, 2017:25).**

<table>
<thead>
<tr>
<th>Line</th>
<th>Type of Structure</th>
<th>Guideline values for velocity, (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1-10 Hz</td>
</tr>
<tr>
<td>1</td>
<td>Buildings used for commercial purposes, industrial buildings, and buildings of similar design</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Dwellings and buildings of similar design and/or occupancy</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Structures that, because of their particular sensitivity to vibration cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order).</td>
<td>3</td>
</tr>
</tbody>
</table>

* At frequencies above 100 Hz the values given in this column may be used as minimum values

Any values exceeding those given in the above table warrant additional investigation (GHD, 2017:25).

Assessment of Vibration Impact

As noted above, vibration is noted as one of the key risks to impact on the tunnel. Line 3 in Table 8 above shows the guideline values applicable for heritage buildings as between 3-10 mm/s, depending on the frequency of the vibration. The vibration level assessed for bored piling is 0.5 mm/s at 10 m distance. This is well within the appropriate values for a heritage item. For a heritage structure, the minimum distance that bored piling can be used before cosmetic damage is at risk is four metres (GHD 2017:31). However, based on Water NSW’s *Requirements for protection of Upper Canal Draft* (Water NSW 2015) GHD have recommended a 3 mm/s vibration velocity level for the Upper Canal and a minimum buffer distance of five metres from the Canal. GHD has recommended further that vibration monitoring should be undertaken during the construction to measure vibration levels and operators alerted if the vibration criteria has been exceeded (GHD 2017:41). In addition, detailed dilapidation surveys of Weston’s Tunnel are recommended to be undertaken both prior to and following construction. The dilapidation surveys are to be submitted to Water NSW for their approval at least four weeks prior to the commencement of construction works. The preparation of an Upper Canal Collapse Contingency Plan due to construction activities will also be prepared and submitted to Water NSW for their approval at least four weeks prior to construction.

Visual Impact

The grassed curtilage of the Upper Canal System provides a “green” buffer to the item, giving it a rural aspect. The current alignment of The Horsley Drive is elevated above the level of the canal (see Plate 24). The new alignment will be approximately 3-4 metres higher than the current alignment.
There is no doubt that the altered height of the new alignment will result in a visually more dominant road than the current alignment. All views within the curtilage of the heritage item will remain the same, with the exception of those views towards north (from the south of The Horsley Drive) and south (from the north of The Horsley Drive).

It should be borne in mind that the canal is of State heritage significance on the basis of its historicity, its association with the architect Edward Orpen Moriarty, its rarity and its technical achievement. It is grouped on the SHR under the heading of “Utilities – Water” in the category of “Water Supply Canal” (State Heritage Register # 01373). Its aesthetics are not considered as an important element of its heritage significance. Because of this it is considered that the views to and from the item are amenable to change. It is clear that the views to and from the item will certainly be impacted, with the road becoming considerably more dominant in the landscape however this change will not adversely affect the heritage significance of the item. This is an especially pertinent point in light of the fact that the section of the item that will be suffer the change of view comprises a very small part of the item as a whole.

Nonetheless, in order to mitigate any perceived loss of views, it is suggested that mature trees be planted along the verge of The Horsley Drive, providing a visual buffer between the item and the new road alignment.

Plate 25 The southern side of the Horsley Drive, looking north. The crepe myrtles can be seen in the top middle of frame, to the right of the access trail. The Horsley Drive is beyond the crepe myrtle trees (RPS, 2016).

Table 9 Assessment of Option 7B

<table>
<thead>
<tr>
<th>Perceived impacts</th>
<th>Yes/No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of fabric</td>
<td>NO</td>
<td>The tunnel crossing will be achieved without loss of fabric. There are two crepe myrtle trees within the curtilage of the Upper Canal System that will be destroyed as part of the proposal, however given their tenuous connection with the canal they are not considered to be significant fabric.</td>
</tr>
<tr>
<td>Direct damage of fabric through construction</td>
<td>NO</td>
<td>The tunnel is in reasonable condition and is no direct construction on the tunnel. No damage to fabric is envisaged, however a conditions assessment will be undertaken immediately prior to and after construction to assess for any change in the fabric of the tunnel.</td>
</tr>
<tr>
<td>Cracking through load of fill</td>
<td>NO</td>
<td>There is no fill to be used for this option. Load will be borne by bored concrete piles.</td>
</tr>
</tbody>
</table>
Perceived impacts | Yes/No | Comments
--- | --- | ---
Visual | NO | The canal tunnel is underground and is currently crossed by The Horsley Drive. As noted above, the additional height of the new alignment will make the road more visible and will encroach on the curtilage of the canal to the south by approximately 40 metres. However, even though this will render the road more visible from the canal, the item or its setting is not considered to be aesthetically significant. The change to views and vistas of the upgrade will therefore be a minor negative impact and will not cause any impact on the significance of either the Weston’s Tunnel portion of the Upper Canal System or the item generally. Given the utilitarian nature of the item it is considered that the impact is within acceptable limits.

Vibration | NO | It is not anticipated that vibration will cause any damage to the tunnel provided that the anticipated vibration level for bored piles remains at 0.5 mm/s at 10 m and that the piling occurs a minimum of four metres from the outermost limit of the tunnel. This level and distance is based on the Noise and Vibration Assessment by GHD (2017).

It is therefore concluded that based on the design methodology, noise and vibration assessment and that proposed monitoring measures are undertaken during construction, Option 7B will not cause any damage to the Upper Canal System.

Bunya Pine

The bunya pine is currently located behind a signage wall for the Smithfield-Wetherill Park Industrial Area. The drawing at Appendix B indicates that the upgrade works will be conducted in the vicinity of the tree.

Based on the submitted drawing, the bunya pine will not be directly impacted by the Proposal. In relation to its setting, the bunya pine is already in a highly modified and urbanised setting, and protected by the stone signage wall. The works as they are currently presented do not include change to this wall and will therefore not impact on the item or its current setting.

6.4 Impact on Potential Archaeological Deposits

As noted in Section 4.4 above, low archaeological potential exists within the curtilage of the Upper Canal System for material associated with the construction of the canal. Also noted above is the advice that the significance of any archaeological material would need to be assessed by a qualified archaeologist. This assessment relates only to non Aboriginal archaeological deposits; an assessment of Aboriginal archaeology is contained in the Cultural Heritage Assessment Report prepared for this project (RPS 2016).

As noted in the historical context above, the area comprising the Proposal Area was part of The Horsley Park estate, with The Horsley Drive roughly following the alignment of the former carriageway leading from Cowpasture Road to the homestead, with the locally significant Bunya Pine marking the entrance. Subdivision of the Estate began in the early twentieth century with a number of small to medium lots being made available, then primarily used for market gardening. Although unlikely to occur, any archaeological deposits along The Horsley Drive will be adversely impacted, including during the pile driving to construct the bridge over the Upper Canal System. As noted above these deposits are likely to be of low significance, therefore should any such deposits be uncovered during any earthworks, the RMS Unexpected Finds protocol should be followed.
6.5 Statement of Heritage Impact

It is considered that the proposed works, being the upgrade of The Horsely Drive, will cause minor-negligible impact to the curtilage of the Upper Canal System (Pheasant’s Nest Weir to Prospect Reservoir) through the construction of the new road and the crossing of Weston’s Tunnel. As discussed above the design of the Weston’s Tunnel crossing has been made with explicit reference to the significance of the Upper Canal System. The highest risk of damage to the item is therefore through vibration during construction. It is assessed, however, provided that mitigation measures are adopted, that there will be no adverse impact on the fabric of the Canal or its heritage significance.

Consideration throughout the concept design has been given to the heritage significance of the item and has been done to limit any damage to Weston’s Tunnel by physically separating the roadway from the heritage fabric by way of a supported void. It is assessed that while some vibration will occur during the boring for the concrete piling it is to be conducted within acceptable ranges and therefore should not cause any damage to the tunnel’s fabric. The Condition Assessment prepared by AECOM in 2015 states that the tunnel is in reasonable condition and the Year to End of Service Life (YESL) is significant. Given this, the Noise and Vibration Assessment and the construction design and methodology, any damage to the item as a result of the Proposal is therefore considered to be negligible.

6.6 Permitting

As an item of State significance, any work within the curtilage of the item will require a permit from the Heritage Division of the Office of Environment & Heritage. The appropriate permit required is dependent upon the level of impact to the significance of the item and the item’s significance.

Section 57 of the Heritage Act 1977 provides that a person must not impact on SHR items except in pursuance of an approval granted by the Heritage Council under Section 60 of that Act. Under Section 57(2) of the Heritage Act 1977 an exemption may be sought on a number of pre-determined grounds, or “Standard Exemptions” (see Table 10 below). These exemptions were gazetted by the Minister under s57 (2) of the Heritage Act 1977 on 11 July 2008 and apply to all items on the State Heritage Register so that works that generally cover maintenance works or works of a minor nature do not require a s60 permit (see Appendix C).

Even in cases where a standard exemption applies, notification to the Heritage Branch is required in most situations (see Table 10 below).

Table 10 Notification requirements for standard exemptions.

<table>
<thead>
<tr>
<th>Standard Exemption Type</th>
<th>Submission Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Maintenance and cleaning</td>
<td>No notice to Heritage Division required</td>
</tr>
<tr>
<td>2. Repairs</td>
<td>No notice to Heritage Division required</td>
</tr>
<tr>
<td>3. Painting</td>
<td>Details of proposed colour scheme, paint type, surface preparation and paint removal and a statement demonstrating no adverse impact on the heritage significance of the item</td>
</tr>
<tr>
<td>4. Excavation</td>
<td>Archaeological assessment or statement demonstrating minor impact or nature of fill (refer to Appendix C for further information)</td>
</tr>
<tr>
<td>5. Restoration</td>
<td>Statement demonstrating the need for and the material and method of restoration and no adverse impact on heritage significance of the item</td>
</tr>
</tbody>
</table>
### Standard Exemption Type

<table>
<thead>
<tr>
<th>Standard Exemption Type</th>
<th>Submission Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Development endorsed by Heritage Council or Director-General</td>
<td>No notice to Heritage Division required</td>
</tr>
<tr>
<td>7. Minor activities with little or no adverse impact on heritage significance</td>
<td>Statement demonstrating that the activity of a minor nature and will not adversely affect the heritage significance of the item (see discussion below)</td>
</tr>
<tr>
<td>8. Non significant fabric</td>
<td>Statement demonstrating no adverse impact on the heritage significance of the item (see discussion below)</td>
</tr>
<tr>
<td>9. Change of use</td>
<td>Statement demonstrating the change of use does not involve alteration of fabric or cessation of the primary use or loss of significant associations (refer to Appendix C for more explanation)</td>
</tr>
<tr>
<td>10. New buildings</td>
<td>No notice to Heritage Division required</td>
</tr>
<tr>
<td>11. Temporary structures</td>
<td>Statement demonstrating no adverse impact on significant fabric (refer to Appendix C for more explanation)</td>
</tr>
<tr>
<td>12. Landscape maintenance</td>
<td>No notice to Heritage Division required</td>
</tr>
<tr>
<td>13. Signage</td>
<td>Statement demonstrating no adverse impact on significant fabric (see Appendix C for further explanation)</td>
</tr>
<tr>
<td>14. Burial sites and cemeteries</td>
<td>Statement demonstrating that monuments and gravemarkers will not be in conflict with the character of the place.</td>
</tr>
<tr>
<td>15. Compliance with minimum standards and orders</td>
<td>No notice to Heritage Division required.</td>
</tr>
<tr>
<td>16. Safety and security</td>
<td>Structural Engineer’s certificate if damaged item poses a safety risk (refer to Appendix C for further discussion)</td>
</tr>
<tr>
<td>17. Movable heritage items</td>
<td>Statement describing the proposed location and the reasons for its relocation</td>
</tr>
</tbody>
</table>

Following assessment of the proposed works and the Standard Exemptions, it is assessed that the Proposal falls outside of the scope of routine maintenance or minor works. The one exemption that may be applicable, being Standard Exemptions 7 that the works are minor and that there will be no impact to the heritage significance as a result of the proposal. Weston’s Tunnel is considered to be contributory to the significance of the Upper Canal System generally, and the impact assessment of the preferred option herein confirms that if all mitigation measures are followed and that the current condition of Weston’s Tunnel is as assessed, no significant harm to the will occur through either vibration during construction or load following construction. This being the case, there will be no impact to the heritage significance as a result of the proposal.

However, in relation to the requirement for the activity to be minor, the activity is essentially a major upgrade of a major arterial road which crosses the item and does not conform to the general understanding of the term “minor activity”. The guidelines for this standard exemption states:

> In determining whether a proposed development is minor the Director may have regard to the context of the particular heritage item such as its size and setting. For instance, a development may be considered to be minor in the context of Prospect Reservoir’s 1200 ha curtilage whereas a similar proposal affecting an item on a smaller site may not be considered to be minor.” (Standard Exemptions, 2008:19).
Whilst all effort will be made to prevent any damage to the tunnel, there is still a low probability that damage will occur through vibration during piling. This probability is less if all recommendations contained in GHD’s *Noise and Vibration Assessment (2017)* and Water NSW’s *Requirements for protection of Upper Canal Draft (2015)* are followed. However, given the significance of the item, it is considered that the scale of the works is not minor and the complexity of the tasks in achieving the upgrade, damage is therefore foreseeable despite all mitigation measures. For these reasons this exemption would not apply.

In addition, although sufficient mitigation measures have been employed to minimise or eliminate any damage to the Upper Canal System and the Weston’s Tunnel, damage during construction is still possible. Because the part of the item most vulnerable to damage is a tunnel, it is foreseeable that damage would not be identified and assessed until after construction is complete.

Given this risk, it is therefore recommended that a permit under s60 of the *Heritage Act 1977* be sought prior to any works taking place. An application for a permit under section 60 must be accompanied by final design plans for the upgrade of The Horsley Drive, including plans for the tunnel crossing, and this Statement of Heritage Impact.

### 6.7 Temporary Construction Basin Site

In addition to the tunnel crossing, drawing DS2016/000627 indicates that a “potential temporary construction basin site” is proposed to be located to the immediate west of the Upper Canal System where it meets with the Horsley Drive. The temporary construction basin site will be constructed outside of the curtilage of the item. The precise location has not yet been established, but it is recommended that it be established a minimum distance from the curtilage boundary of the Upper Canal System. This minimum distance should be negotiated with Water NSW, however should the final location of the temporary construction basin be established within five metres of the curtilage boundary, it is recommended that an addendum to this Statement of Heritage Impact and a variation to any permit application be prepared prior to any works taking place.
7 Conclusion and Recommendations

7.1 Conclusion

This report has considered the significance of the proposed works associated with the upgrade of The Horsley Drive and the nature and scale of likely heritage impacts as a result of the development proposal. It is concluded that:

- There are two heritage items within the Proposal Area;
- The Upper Canal System is of State significance;
- The Bunya pine is of local significance.

As a result, the following recommendations are made for the protection of the two heritage items.

7.2 Recommendations

The following management recommendations and mitigation measures have been formulated with consideration of all available information in accordance with relevant legislation:

Recommendation 1 – Application for a Section 60 Permit

It is recommended that application be made to the Heritage Division for a permit under s60 of the Heritage Act 1977. An application form must be completed and accompanied by final design plans, including plans for the tunnel crossing, and this Statement of Heritage Impact.

Recommendation 2 – Vibration mitigation

It is recommended that the vibration levels set out in GHD’s Noise and Vibration Assessment (2017) in relation to the construction in the vicinity of Weston’s Tunnel of the Upper Canal System be followed. Those levels are 3 mm/s vibration velocity level and a minimum buffer distance of five metres from the Canal. It is recommended further that these levels be monitored during construction and alerting any operators who are approaching that level.

Recommendation 3 – Water NSW Requirements

It is recommended that consultation with Water NSW continue before, during and after the construction phase and that any works in the vicinity of the Upper Prospect Canal be approved by them prior to commencing. Construction must conform to the Water NSW document Requirements for protection of Upper Canal Draft (2015).

Recommendation 4 – Dilapidation surveys and restoration

It is recommended that a dilapidation survey of Weston’s Tunnel be prepared to assess its condition prior to construction. It is recommended further that a dilapidation survey of Weston’s Tunnel brick lining be prepared to assess its condition after construction. Should any change have occurred to the brick lining of the tunnel as a result of the construction it is recommended that RMS engage the services of a contractor experienced in the repair of heritage brickwork to restore the tunnel to its pre-construction condition.
Recommendation 5 – Temporary construction basin

It is recommended that the location of the temporary construction basin be negotiated with RMS, Western Sydney Parklands Trust and Water NSW. It is recommended further that the temporary construction basin be constructed at least five metres from the heritage curtilage boundary of the Upper Canal System (as defined on the State Heritage Register). If this is not feasible then an addendum to this Statement of Heritage Impact must be undertaken to assess the potential for any damage to the Upper Canal System as a result of the construction of the temporary construction basin.

Recommendation 6 – Protection for Bunya Pine

It is recommended that protective fencing be placed around the foot of the Bunya Pine to avoid accidental damage to the tree through vehicle and plant movement.

Recommendation 7 – Heritage Induction

It is recommended that a heritage induction exercise be carried out in advance of the proposed works. All relevant staff, contractors and subcontractors will be made aware of their statutory obligations for heritage under the Heritage Act 1977, through the site induction and toolbox talks.

Recommendation 8 – Archival Recording

It is considered that the impact on Weston’s tunnel will be a minor negative impact. Consequently, it is recommended that an Archival Recording of Weston’s Tunnel and the associated section of the Upper Canal System is undertaken prior to any works. Such recording should be done in line with the Photographic Recording of Heritage Items Using Film or Digital Capture published by the Heritage Division. The recording should also include a photographic record taken from within Water NSW land looking to the north and south of the existing road, as well as the stand of crepe myrtles at the south of The Horsley Drive and the concrete gate posts to the north of The Horsley Drive.

Recommendation 9 – Planting of Screen Trees

In order to safeguard any perceived visual impact to the Upper Canal System by the construction of the new alignment of The Horsley Drive, it is recommended that mature trees are planted along the verges of the crossing of the Upper Canal System by the new alignment.

Recommendation 10 – Unexpected Finds

If, during the course of construction works, suspected archaeological relics as defined by the Heritage Act 1977 are uncovered, the RMS Unexpected Finds Protocol is to be followed. A copy of this protocol is to be kept on site at all times. If any unexpected finds are identified within the curtilage of the Upper Canal System Water NSW must be notified and a qualified archaeologist engaged to identify the significance of the finds.
8 References


Hunter, J. (1793 [1968]). An Historical Journal of the Transactions at Port Jackson and Norfolk Island, ... including the journals of Governors Phillip and King, and of Lieut. Ball; and the boyages from the first sailing of the Sirius in 1787 to the return of that Ship's company to England in 1792. Adelaide, Libraries Board of South Australia.

Library Committee of the Commonwealth Parliament (1914). Historical Records of Australia, Series 1, Governors’ despatches to and from England, Commonwealth of Australia.


Appendix A

State Heritage Register listing for Upper Canal System
Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)

Item details

Name of item: Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)
Other name/s: includes the Southern Railway Aqueduct; Cataract Tunnel; water supply
Type of item: Complex / Group
Group/Collection: Utilities - Water
Category: Water Supply Canal
Location: Lat: -33.91548201400 Long: 150.828630839
Primary address: Prospect, NSW 2148
Local govt. area: Blacktown
Local Aboriginal Land Council: Tharawal

Property description

<table>
<thead>
<tr>
<th>Lot/Volume Code</th>
<th>Lot/Volume Number</th>
<th>Section Number</th>
<th>Plan/Folio Code</th>
<th>Plan/Folio Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOT 11</td>
<td>DP</td>
<td></td>
<td>1055232</td>
<td></td>
</tr>
<tr>
<td>LOT 12</td>
<td>DP</td>
<td></td>
<td>1055232</td>
<td></td>
</tr>
<tr>
<td>PART LOT 1</td>
<td>DP</td>
<td></td>
<td>1062094</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>1086624</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>1086624</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>1086645</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>1086645</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>1086648</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>596351</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>596351</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>596352</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>596353</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>596353</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>596354</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>596355</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>603946</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>603946</td>
<td></td>
</tr>
<tr>
<td>LOT 3</td>
<td>DP</td>
<td></td>
<td>603946</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>610145</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>610146</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>613552</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>616147</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>616147</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>616271</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>616271</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>619850</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>619850</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>623825</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>623825</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>625921</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>625921</td>
<td></td>
</tr>
<tr>
<td>LOT 3</td>
<td>DP</td>
<td></td>
<td>625921</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>717439</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>717439</td>
<td></td>
</tr>
<tr>
<td>LOT 3</td>
<td>DP</td>
<td></td>
<td>717439</td>
<td></td>
</tr>
<tr>
<td>LOT 1</td>
<td>DP</td>
<td></td>
<td>719962</td>
<td></td>
</tr>
<tr>
<td>LOT 2</td>
<td>DP</td>
<td></td>
<td>719962</td>
<td></td>
</tr>
</tbody>
</table>
Upper Canal System (Pheasants Nest Weir to Prospect Reservoir) | N... http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDet...
The Canal is aesthetically significant, running in a serpentine route through a rural bushland setting as an impressive landscape element with sandstone and concrete-lined edges;

The Canal is significant as it demonstrates the techniques of canal building, and evidence of engineering practice. The Canal as a whole is an excellent example of 19th century hydraulic engineering, including the use of gravity to feed water along the canal (BCubed Sustainability, 2/2006).

The Upper Nepean Scheme is significant because:

* In its scope and execution, it is a unique and excellent example of the ingenuity of late 19th century hydraulic engineering in Australia, in particular for its design as a gravity-fed water supply system.

* It has functioned as a unique part of the main water supply system for Sydney for over 100 years, and has changed little in its basic principles since the day it was completed.

* It represented the major engineering advance from depending on local water sources to harvesting water in upland catchment areas, storing it in major dams and transporting it the city by means of major canals and pipelines.

* It provides detailed and varied evidence of the engineering construction techniques prior to the revolution inspired by reinforced concrete construction, of the evolution of these techniques (such as the replacement of timber flumes with wrought iron and then concrete flumes), and of the early use of concrete for many engineering purposes in the system.

* The scheme possesses many elements of infrastructure which are of world and national renown in technological and engineering terms.

* Many of the structural elements are unique to the Upper Nepean Scheme.

(Edward Higginbotham & Associates, SCA Heritage and Conservation Register, 18 December 2000)

**Date significance updated:** 22 Apr 10

**Note:** There are incomplete details for a number of items listed in NSW. The Heritage Division intends to develop or upgrade statements of significance and other information for these items as resources become available.

### Description

**Date condition updated:** 13 Feb 06

**Current use:** water supply

**Former use:** Aboriginal land; private farming land

### History

**Historical notes:** Aboriginal & European settler history:

The area of Prospect Reservoir is an area of known Aboriginal occupation, with favourable camping locations along the Eastern Creek and Prospect Creek catchments, and in elevated landscapes to the south. There is also evidence to suggest that the occupation of these lands continued after European contact, through discovery of intermingled glass and stone flakes in archaeological surveys of the place. The area was settled by Europeans by 1789.

Prospect Hill, Sydney's largest body of igneous rock, lies centrally in the Cumberland Plain and dominates the landscapes of the area (Ashton, 2000). Very early after first settlement, on 26 April 1788, an exploration party headed west led by Governor Phillip, climbed Prospect Hill. An account by Phillip states that the exploration party saw from Prospect Hill, 'for the first time since we landed Carmathen Hills (Blue Mountains) as likewise the hills to the southward'. Phillip's 'Bellevue' (Prospect Hill) acquired considerable significance for the new settlers. Prospect Hill provided a point from which distances could be meaningfully calculated, and became a major reference point for other early explorers (Karskens 1991). When Watkin Tench made another official journey to the west in 1789, he began his journey with reference to Prospect Hill, which commanded a view of the great chain of mountains to the west. A runaway convict, George Bruce, used Prospect Hill as a hideaway from soldiers in the mid-1790's.

During the initial struggling years of European settlement in NSW, Governor Phillip began to...
settle time-expired convicts on the land as farmers, after the success of James Ruse at Rose Hill (Higginbotham 2000). On 18 July 1791 Phillip placed a number of men on the eastern and southern slopes of Prospect Hill, as the soils weathered from the basalt cap were richer than the sandstone derived soils of the Cumberland Plain. The grants, mostly 30 acres, encircled Prospect Hill (Ashton 2000). The settlers included William Butler, James Castle, Samuel Griffiths, John Herbert, George Lisk, Joseph Morley, John Nicols, William Parish and Edward Pugh (Higginbotham 2000).

The arrival of the first settlers prompted the first organised Aboriginal resistance to the spread of settlement, with the commencement of a violent frontier conflict in which Pemulwuy and his Bidjigal clan played a central role (Flynn 1997). On 1 May 1801 Governor King took drastic action, issuing a public order requiring that Aboriginal people around Parramatta, Prospect Hill and Georges River should be 'driven back from the settlers' habitations by firing at them'. Kings edicts appear to have encouraged a shoot-on-sight attitude whenever any Aboriginal men, women or children appeared (Flynn 1997).

With the death of Pemulwuy, the main resistance leader, in 1802, Aboriginal resistance gradually diminished near Parramatta, although outer areas were still subject to armed hostilities. Prompted by suggestions to the Reverend Marsden by local Prospect Aboriginal groups that a conference should take place 'with a view of opening the way to reconciliation', Marsden promptly organised a meeting near Prospect Hill. (ibid 1997). At the meeting, held on 3 May 1805, local Aboriginal representatives discussed with Marsden ways of ending the restrictions and indiscriminate reprisals inflicted on them by soldiers and settlers in response to atrocities committed by other Aboriginal clans (ibid 1997). The meeting was significant because a group of Aboriginal women and a young free settler at Prospect named John Kennedy acted as intermediaries. The conference led to the end of the conflict for the Aboriginal clans around Parramatta and Prospect (Karskens 1991). This conference at Prospect on Friday 3 May 1805 is a landmark in Aboriginal/European relations. Macquarie's 'Native Feasts' held at Parramatta from 1814 followed the precedent set in 1805. The Sydney Gazette report of the meeting is notable for the absence of the sneering tone that characterised its earlier coverage of Aboriginal matters (ibid 1997).

From its commencement in 1791 with the early settlement of the area, agricultural use of the land continued at Prospect Hill. Much of the land appears to have been cleared by the 1820s and pastoral use of the land was well established by then. When Governor Macquarie paid a visit to the area in 1810, he was favourably impressed by the comfortable conditions that had been created (Pollon & Healy, 1988, 210).

Nelson Lawson, third son of explorer William Lawson (1774-1850), married Honoria Mary Dickinson and before 1837 built "Greystanes House" as their future family home on the western side of Prospect Hill. Lawson had received the land from his father, who had been granted 500 acres here by the illegal government that followed the overthrow of Governor Bligh in 1808.

Governor Macquarie confirmed the grant, where William Lawson had built a house, which he called "Veteran Hall", because he had a commission in the NSW Veterans Company. The house was demolished in 1928 and the site is now partly covered by the waters of Prospect Reservoir. Greystanes was approached by a long drive lined with an avenue of English trees - elms (Ulmus procera), hawthorns (Crataegus sp.), holly (Ilex aquifolium), and woodbine (Clematis sp.) mingling with jacarandas (J.mimosifolia). It had a wide, semi-circular front verandah supported by 4 pillars. The foundations were of stone, the roof of slate, and the doors and architraves of heavy red cedar. It was richly furnished with articles of the best quality available and was the scene of many glittering soirees attended by the elite of the colony. Honoria Lawson died in 1845, Nelson remarried a year later, but died in 1849, and the property reverted to his father. Greystanes house was demolished in the 1940s (Pollon, 1988, 116, amended Read, S.,2006 - the house can't have been 'on the crest' of Prospect Hill as Pollon states, if its site was covered by the Reservoir).

By the 1870s, with the collapse of the production of cereal grains across the Cumberland Plain, the Prospect Hill area appears to have largely been devoted to livestock. The dwellings of the earliest settlers largely appear to have been removed by this stage. By the time that any mapping was undertaken in this vicinity, most of these structures had disappeared, making their locations difficult to pinpoint (Higginbotham 2000).

The land was farmed from 1806-1888 when the Prospect Reservoir was built. In 1867, the Governor of NSW appointed a Commission to recommend a scheme for Sydney's water supply, and by 1869 it was recommended that construction commence on the Upper Nepean Scheme. This consisted of two diversion weirs, located at Pheasant's Nest and Broughton's Pass, in the Upper Nepean River catchment, with water feeding into a series of tunnels, canals and aqueducts known as the Upper Canal. It was intended that water be fed by gravity from
the catchment into a reservoir at Prospect. This scheme was to be Sydney’s fourth water supply system, following the Tank Stream, Busby’s Bore and the Botany (Lachlan) Swamps.

Designed and constructed by the Public Works Department of NSW, Prospect Reservoir was built during the 1880s and completed in 1888. Credit for the Upper Nepean Scheme is largely given to Edward Orpen Moriarty, the Engineer in Chief of the Harbours and Rivers Branch of the Public Works Department from 1858-88 (B Cubed Sustainability, 2005, 7).

Upper Canal System:

In 1867, the Governor of NSW appointed a Commission to recommend a scheme for Sydney’s water supply, and by 1869 it was recommended that construction commence on the Upper Nepean Scheme. This consisted of two diversion weirs, located at Pheasant’s Nest and Broughton’s Pass, in the Upper Nepean River catchment, with water feeding into a series of tunnels, canals and aqueducts known as the Upper Canal. It was intended that water be fed by gravity from the catchment into a reservoir at Prospect. This scheme was to be Sydney’s fourth water supply system, following the Tank Stream, Busby’s Bore and the Botany (Lachlan) Swamps.

Designed and constructed by the Public Works Department of NSW, Prospect Reservoir was built during the 1880s and completed in 1888. Credit for the Upper Nepean Scheme is largely given to Edward Orpen Moriarty, the Engineer in Chief of the Harbours and Rivers Branch of the Public Works Department from 1858-88 (B Cubed Sustainability, 2005, 7).

### Historic themes

<table>
<thead>
<tr>
<th>Australian theme (abbrev)</th>
<th>New South Wales theme</th>
<th>Local theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Economy</td>
<td>Environment - cultural landscape-Activities associated with the interactions between humans, human societies and the shaping of their physical surroundings</td>
<td>Developing local, regional and national economies-National Theme 3</td>
</tr>
<tr>
<td>3. Economy</td>
<td>Environment - cultural landscape-Activities associated with the interactions between humans, human societies and the shaping of their physical surroundings</td>
<td>Landscapes and countryside of rural charm</td>
</tr>
<tr>
<td>3. Economy</td>
<td>Environment - cultural landscape-Activities associated with the interactions between humans, human societies and the shaping of their physical surroundings</td>
<td>Landscapes of urban and rural interaction</td>
</tr>
<tr>
<td>3. Economy</td>
<td>Environment - cultural landscape-Activities associated with the interactions between humans, human societies and the shaping of their physical surroundings</td>
<td>Landscapes of scenic beauty</td>
</tr>
<tr>
<td>4. Settlement</td>
<td>Land tenure-Activities and processes for identifying forms of ownership and occupancy of land and water, both Aboriginal and non-Aboriginal</td>
<td>Changing land uses - from rural to suburban</td>
</tr>
<tr>
<td>4. Settlement</td>
<td>Land tenure-Activities and processes for identifying forms of ownership and occupancy of land and water, both Aboriginal and non-Aboriginal</td>
<td>Resuming private lands for public purposes</td>
</tr>
<tr>
<td>4. Settlement</td>
<td>Land tenure-Activities and processes for identifying forms of ownership and occupancy of land and water, both Aboriginal and non-Aboriginal</td>
<td>Granting Crown lands for private farming</td>
</tr>
<tr>
<td>4. Settlement</td>
<td>Land tenure-Activities and processes for identifying forms of ownership and occupancy of land and water, both Aboriginal and non-Aboriginal</td>
<td>Sub-division of large estates</td>
</tr>
<tr>
<td>4. Settlement</td>
<td>Land tenure-Activities and processes for identifying forms of ownership and occupancy of land and water, both Aboriginal and non-Aboriginal</td>
<td>Early farming (Cattle grazing)</td>
</tr>
</tbody>
</table>
Assessment of significance

SHR Criteria a) [Historical significance]
The Upper Nepean Scheme has functioned as part of the main water supply system for Sydney since 1888. Apart from the augmentation and development in supply and other improvements, the Upper Canal and Prospect Reservoir portions of the Scheme have changed little and in most cases operate in essentially the same way as was originally envisaged.

SHR Criteria b) [Associative significance]
The construction of the Upper Nepean Scheme made the big advance from depending on local water sources to harvesting water in upland catchment areas, storing it in major dams and transporting it to the city by means of major canals and pipelines.

SHR Criteria e) [Research potential]
The Upper Nepean Scheme provides detailed and varied evidence of engineering construction techniques prior to the revolution inspired by reinforced concrete construction. Although concrete was later used to improve the durability of the System, much of the earlier technology is still evident along the canal.

It also provides extensive evidence of the evolution of engineering practice, such as the replacement of timber flumes by wrought iron flumes to be followed by concrete flumes. The early utilisation of concrete for many engineering purposes in the System, also demonstrates the growing emergence of engineering technology based upon man-made materials.

SHR Criteria f) [Rarity]
Many of the original control installations such as the ’Stoney gates’, stop logs, penstocks, gate valves are still in service and continue to illustrate the technology of the time.

The Upper Nepean Scheme is unique in NSW, being the only extensive canal, reservoir and dam network to supply a large city and its population with fresh water from a distant source in the hinterland. This type of water supply system is also rare in Australia and only has major comparative examples in other countries.

Assessment criteria:
Items are assessed against the State Heritage Register (SHR) Criteria to determine the level of significance. Refer to the Listings below for the level of statutory protection.

Procedures /Exemptions

<table>
<thead>
<tr>
<th>Section of act</th>
<th>Description</th>
<th>Title</th>
<th>Comments</th>
<th>Action date</th>
</tr>
</thead>
<tbody>
<tr>
<td>57(2)</td>
<td>Exemption to allow work</td>
<td>Standard Exemptions</td>
<td>SCHEDULE OF STANDARD</td>
<td>Sep 5 2008</td>
</tr>
</tbody>
</table>
EXEMPTIONS

HERITAGE ACT 1977

Notice of Order Under Section 57 (2) of the Heritage Act 1977

I, the Minister for Planning, pursuant to subsection 57(2) of the Heritage Act 1977, on the recommendation of the Heritage Council of New South Wales, do by this Order:

1. revoke the Schedule of Exemptions to subsection 57(1) of the Heritage Act made under subsection 57(2) and published in the Government Gazette on 22 February 2008; and

2. grant standard exemptions from subsection 57(1) of the Heritage Act 1977, described in the Schedule attached.

FRANK SARTOR
Minister for Planning
Sydney, 11 July 2008

To view the schedule click on the Standard Exemptions for Works Requiring Heritage Council Approval link below.

Standard exemptions for works requiring Heritage Council approval

<table>
<thead>
<tr>
<th>Heritage Listing</th>
<th>Listing Title</th>
<th>Listing Number</th>
<th>Gazette Date</th>
<th>Gazette Number</th>
<th>Gazette Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heritage Act - State Heritage Register</td>
<td></td>
<td>01373</td>
<td>18 Nov 99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heritage Act - s.170 NSW State agency heritage register</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEPP Major Developments - Heritage Item</td>
<td>Appendix 10 Schedule 5 Item</td>
<td></td>
<td>02 Jul 06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Environmental Plan</td>
<td>Liverpool LEP 2008</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Environmental Plan</td>
<td>Campbelltown LEP - District 8 (Central Hills Lands</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Environmental Plan</td>
<td>Wollondilly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Trust of Australia register</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Study details

| Title | Year | Number | Author | Inspected by | Guidelines used |
|-------|------|--------|--------|--------------|----------------|}

References, internet links & images
<table>
<thead>
<tr>
<th>Type</th>
<th>Author</th>
<th>Year</th>
<th>Title</th>
<th>Internet Links</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written</td>
<td>Australian Museum Business Services</td>
<td>2008</td>
<td>Statement of heritage impact: Pheasant's Nest and Broughton's Pass Weirs: Environmental Flow Releases for the Upper Hawkesbury-Nepean River</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>B Cubed Sustainability</td>
<td>2006</td>
<td>Upper Canal Aqueduct Scour Valves Upgrade Heritage Impact Statement (June 2006)</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>B Cubed Sustainability P/L</td>
<td>2005</td>
<td>Prospect (Reservoir) Scout/Outlet - Heritage Impact Statement</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Biosys P/L</td>
<td>2016</td>
<td>Gledswood Hills bridge crossing over the Upper Canal: European Heritage Archaeological Monitoring Report</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Biosys P/L</td>
<td>2016</td>
<td>Gledswood Hills Collector Road adjacent to the Upper Canal: European Heritage Archaeological Monitoring Report</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Britton, Geoffrey</td>
<td>2002</td>
<td>Upper Canal Cultural Landscape (Appendix 1.4 in Higginbotham CMP 2002)</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Cardno MBK</td>
<td>2003</td>
<td>Effects of Mining of Longwalls 5A5, 5A6, 5A7 and 5A8 - Interim Report - Open Canals and Concrete Aqueducts C and D (August 2003)</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Cardno P/L</td>
<td>2015</td>
<td>Dilapidation Report - Gledswood Hills - SCA Mollesman Tunnel (Molles Main)</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Eco Logical Australia</td>
<td>2013</td>
<td>East Leppington Precinct - Vegetation Management Plan</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Edward Higginbotham &amp; Associates</td>
<td>2002</td>
<td>Conservation Management Plan for the Upper Canal, Pheasant's Nest to Prospect Reservoir</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Edward Higginbotham, Terry Kass, Vince Murphy, John Collocott, Toby Flander, Siobhan Lavelle</td>
<td>1992</td>
<td>Heritage Study of the Upper Canal, Prospect Reservoir &amp; Lower Canal (Upper Nepean Scheme): Volume 3 - Conservation Policy</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>GML Heritage</td>
<td>2014</td>
<td>East Leppington - update of Aboriginal heritage works (letter)</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Godden Mackay Logan Heritage Consultants</td>
<td>2014</td>
<td>East Leppington (Willowdale) Precinct 3 - Heritage Assessment and Impact Statement Report</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>JMD Design</td>
<td>2014</td>
<td>Upper Canal Landscape and Interface Strategy</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>JMD Design</td>
<td>2014</td>
<td>Willowdale SCA Canal Interface Montages (various views of canal/adjacent housing)</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>JMD Design</td>
<td>2014</td>
<td>Willowdale - Master Plan</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>JMD Design</td>
<td>2014</td>
<td>Willowdale - Landscape Features</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Lawrie Greenup</td>
<td>2009</td>
<td>Upper canal and infrastructures affected by LW409 mining : archival photographic recording</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>Martin James</td>
<td>2006</td>
<td>Upper Canal Aqueduct Scour Valves Upgrade Review of Environmental Factors</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>NSW Office of Environment &amp; Heritage</td>
<td>2013</td>
<td>Issue of Aboriginal Heritage Impact Permit 1132181</td>
<td></td>
</tr>
<tr>
<td>Written</td>
<td>RTA Operations</td>
<td>2003</td>
<td>Statement of Heritage Impact</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Concept Design Drawings