

Upper Canal

Syphon Cleaning and Investigation

Statement of Heritage Impact

(To accompany a s60 fast track application under the Heritage Act, 1977)

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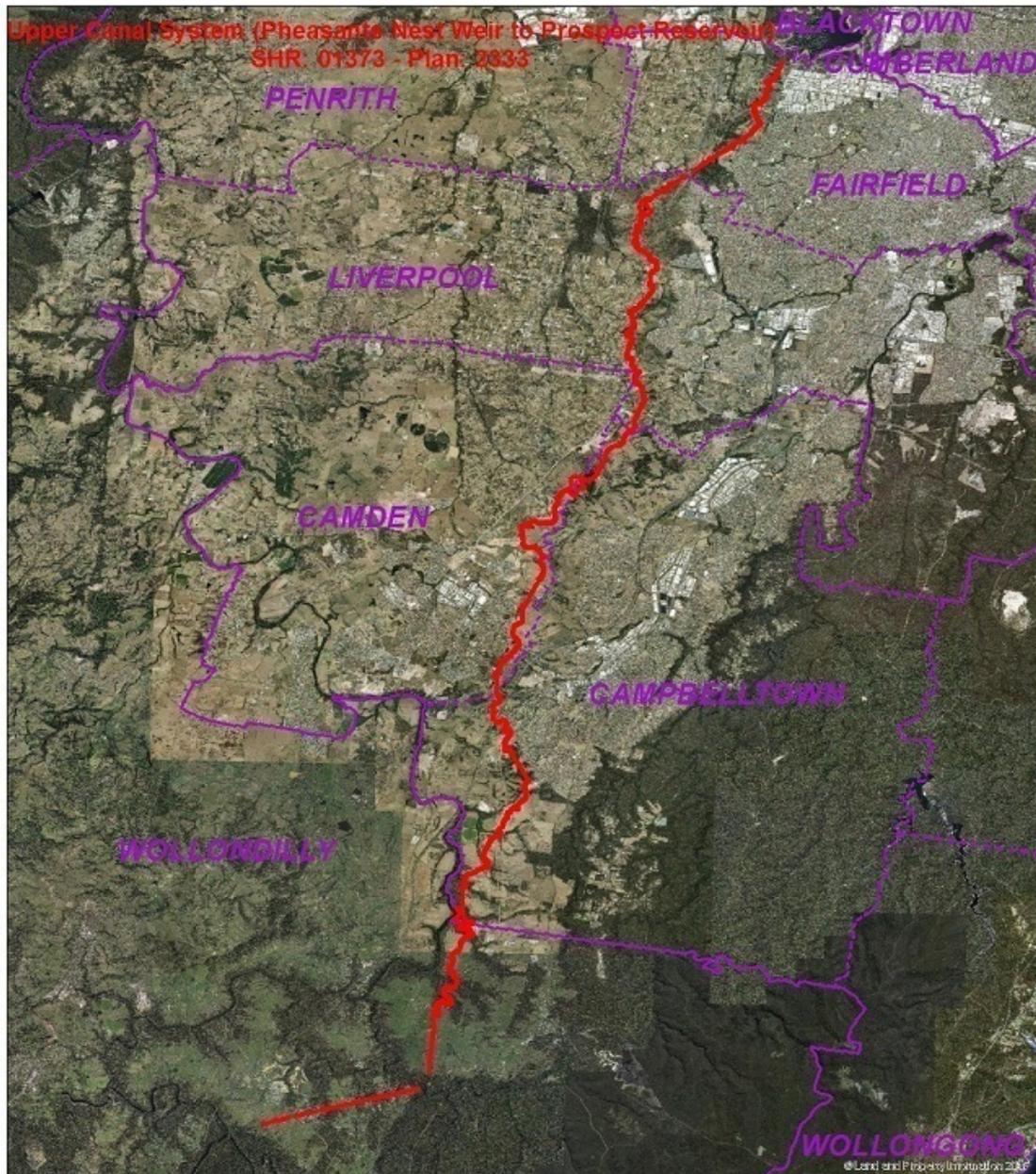
1. Introduction

The Upper Canal forms a key part of the Upper Nepean Scheme and Sydney's water supply system. The Canal is owned and managed by WaterNSW. Constructed in 1888 the Upper Canal is listed on the NSW State Heritage Register in recognition of its outstanding heritage significance. The 'Canal' sits within a linear corridor and includes over one hundred item types including the open canal itself, tunnels, aqueducts, bridges, various types of drainage, cultural plantings, depots and archaeological sites.

WaterNSW proposes to clean and investigate all of the Syphons along the Upper Canal. No repairs will be undertaken unless the investigation identifies the unlikely situation of an emergency with a syphon(s). Any repairs will be done in line with the Conservation Management Plan (GAO, 2016) for the asset.

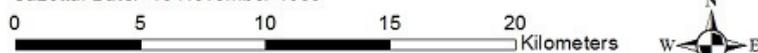
2. Location

The Upper Canal commences at its most southerly point at the Pheasant's Nest Weir (south of Appin) and finishes in the north at Prospect Reservoir near Blacktown in western Sydney. It runs through the local government areas of Wollondilly, Campbelltown, Camden, Liverpool and Fairfield. The Upper Canal is in the ownership of WaterNSW.



State Heritage Register - SHR 01373, Plan 2333
 Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)
 Prospect

Gazettal Date: 18 November 1999



Legend

- SHR Curtilage
- LGAs

Figure 1 – Overview of the location of the Upper Canal based on its curtilage (Heritage NSW)

3. Heritage Listings

The following heritage listings apply to the Upper Canal:

Register	Listing Name and Number	Status
State Heritage Register	Upper Canal (SHR 01373)	State
Wollondilly Shire LEP 2021	Upper Nepean Scheme – Upper Canal (155)	State
Camden Council LEP 2019	Upper Canal (1122)	State
Campbelltown City Council (2021)	Upper Canal System (101373)	State
SEPP Precincts—Western Parkland City) 2021	Upper Canal System (7)	State
WaterNSW s170 Register	Upper Canal (as part of the Upper Nepean Scheme)	State

4. Heritage Significance, Site and Asset Description

The following is taken from the CMP by Government Architects Office (2016):

The Upper Canal has STATE heritage significance.

The Upper Canal, as part of the Upper Nepean Scheme, has been in use as a gravity fed water supply system and a key part of Sydney's water supply without substantial alteration to its fabric since its completion in 1888. It operates in essentially the same way as was originally envisaged. The Upper Canal is unique in NSW, being the only extensive gravity fed water supply canal system to supply a large city and its population with fresh water from a distant source in the hinterland. This type of water supply system also appears to be rare in Australia. The rarity of the Canal is enhanced by its integrity and its continuing operation largely using the original infrastructure built in the 1880s which still operates as originally intended. Such intact systems demonstrating an array of nineteenth century engineering techniques are rare.

As a key component in the Upper Nepean Scheme, the Upper Canal is related to the major NSW historic theme of utilities. The provision of potable water is a first priority in any settlement and influences the success of all settlement building endeavours. The Upper Canal supported the development and expansion of Sydney, NSW's largest and most important settlement, particularly

during the late nineteenth and early twentieth centuries, a period of rapid population growth and industrial development.

It is an excellent example of the ingenuity of late nineteenth century hydraulic engineering, in particular for its design as a gravity-fed water supply system through difficult terrain. The Upper Canal is an outstanding benchmark site demonstrating a range of late nineteenth century engineering techniques and innovations in water supply technology, particularly techniques in use prior to the revolution inspired by reinforced concrete construction. Although concrete was later used to improve the durability of the Canal, much of the earlier technology is still evident along the Canal.

The Canal itself is an impressive landscape element with its sandstone and concrete lined edges and serpentine route - based on gentle engineered curves - as it negotiates the complex topography along its route. There are numerous areas of significant plantings along the route of the Canal, particularly some avenues of pines dating to the construction of the Canal. The Canal corridor is known to contain a range of historical archaeological sites associated with the construction and operation of the Canal as well as Aboriginal sites that pre-date the Canal's construction. These sites may contribute knowledge about the local area and the lives of the construction workers not available from other sources.

There are a number of forms of syphons on the Upper Canal. The syphons were built to allow upslope flows on one side of the canal to pass under the canal to the downslope side. This prevented any water pollution entering the water of the Upper Canal. The syphons still function as intended even though they were built in the 1880's. They are described as per the following Table:

Brick Inverted Syphon



Eg: Section 9 – Item 9.24

A number of inverted syphon brick culverts and drains run below the Canal. These are generally constructed as a three ring arched brick inlet. Variations include:

- Head walls- sandstone, brick, concrete;
- Trash racks;
- Splayed or straight brick side walls sometimes rendered;
- Feeder channels often with sandstone flagstone apron and retaining walls;
- Culvert width (24 to 72 inch).
- Extension with iron pipe.

The syphons are assessed as having EXCEPTIONAL significance (GAO, 2016).

Stone inverted syphon



Eg: Section 2 – Item 2.25

A series of masonry (sandstone) inverted syphon culverts and drains run below the Upper Canal and access roads. These are generally constructed from:

- arch of stone voussoirs forming the culvert inlet;
- headwall and coping;
- rectangular box shaped sump with vertical sandstone walls, sides sloping down from headwall;
- apron and retaining walls.

Variations include:

- side walls sloping or straight;
- size of the culvert;
- headwall and coping materiality- stone, brick, rendered;
- trash racks.

The syphons are assessed as having EXCEPTIONAL significance (GAO, 2016).

Other	
	<p>A number of syphons are also concrete and metal structures. The concrete structures are later builds and are intrusive.</p>
<p>Eg Near Prospect Reservoir (P8)</p>	

There is a comprehensive spreadsheet of the syphons attached in a separate file in Appendix A.

5. Scope of Works

There are 63 syphons under the Upper Canal that will be cleaned and inspected. The inspection will take place by CCTV machinery that will travel through the syphon. The camera will be on wheels as pictured below and will be sent through each syphon to gain imagery. The camera (iPEK Rovion CCTV Inspection System) will not damage the syphons as it has rubber wheels and will be operated by an experienced operator.



Figure 2: Camera to be used in recording the Syphons.

In order to gain an accurate picture of the syphons WaterNSW proposes to have the syphons cleaned by the contractor to enhance the CCTV image and inspection.

A combination jet and vacuum truck will be used to clean the syphon structure and remove

any excess dirty water, dirt layers, organic growths, etc so the CCTV inspection can take place.

This will be managed by two operators working in and around the syphons. Due to the time since the last inspection of this nature and the need to study the condition of the fabric in close up detail, it is proposed to use water at a pound per square inch (psi) in the order of 1500 to 1800 with a maximum of 2000 psi.

To ensure that there are no impacts to fabric a 'test patch' will be undertaken on the different fabric of the syphons to prevent any unintentional damage. If there is damage then the psi will be reduced.

To facilitate access to the syphons any grates that cover the entry and/or exit points will be removed short term and replaced after the cleaning and inspection has occurred. The grates are there to prevent ingress to an unsafe environment and keep fauna out of the syphons.

6. Heritage Impact Statement

There will be no adverse impact to the State Heritage Item of the Upper Canal or the Syphons along the Upper Canal.

The works to clean and inspect the Syphons along the Upper Canal will allow for an inspection of all the existing syphons. The main potential impact is the use of water for cleaning the syphons in the range of 1500-1800 psi with a limit of 2000 psi. WaterNSW needs to undertake the cleaning at this pressure to ensure the syphons are cleaned and visible for the inspection by CCTV to take place. The inspection will help WaterNSW develop a repair and/or updated maintenance program for the syphons.

Access to the syphons will require the temporary removal of grates where they are located on the Upper Canal. This is a short term impact and the grates will be returned to their original location on the syphons ensuring there is no impact to the fabric of the structures.

While Standard Exemption 1 : Maintenance and Cleaning allows for cleaning, relevant standard h) requires that "cleaning of significant fabric may only use low pressure water less than 100 psi and neutral detergents". As the majority of the syphons are rated as having Exceptional significance, Standard Exemption 1 can not be used to undertake the works and an approval under s60 of the *Heritage Act 1977* is required.

The use of the higher pressure is appropriate for these works and will not impact the fabric of

the syphons. In line with the Information Sheet 6.1 – Cleaning Masonry Walls a test patch area will be used on each of the syphons and the psi may have to be reduced if there are any unacceptable impacts to the masonry or the jointing, especially for the brick syphons. The sandstone syphons do not have mortar as the Upper Canal was initially constructed without mortar between the sandstone blocks. There will be no use of detergent during the cleaning works.

There is no specific Policy or Guideline within the CMP that relates to cleaning of masonry. It is not a usual activity that WaterNSW undertakes. Thus the works do not conflict with any Policy included in the CMP. The syphons are under the Upper Canal and the resulting works are not visible to the public as the Upper Canal is a Controlled Area where public access is prohibited. The CCTV camera to be used has rubber wheels and there will be no damage from the use of the camera to the syphon fabric.

The works will actually have a positive impact - the syphons will be cleaned and recorded with up to date imagery and a program of works developed if the syphons need remedial actions to preserve the structures long term. They play a crucial role in keeping the Upper Canal water supply clean and removing water from one side of the Canal to the other, protecting the asset.

7. Conclusion

The works to be undertaken will not have a significant impact on the heritage item that is the Upper Canal. While the water pressure cleaning to be used is above the relevant standard that is acceptable for the use of Standard Exemption 1, the proposed use of 1500 to 1800 psi with a maximum of 2000 psi is required.

WaterNSW needs to use this level for investigation and cleaning purposes so the syphon fabric can be inspected and a works program for repair of any defects can be formulated. Any proposed works beyond maintenance and repair will be further assessed and a s60 approval obtained.

A s60 fast track application is appropriate as the works overall will have little to no adverse impact on the heritage significance of the Upper Canal, the cleaning will cost under \$150,000 and the works could not be done as a Standard Exemption as WaterNSW will use a pressure above the relevant standard of 100psi to fully clean and inspect the syphons.

8. References

Government Architects Office (2016) Upper Canal Conservation Management Plan. Prepared for WaterNSW.

The Maintenance of Heritage Assets. Information Sheet 6.1 – Cleaning Masonry Walls. March 1998. Endorsed by the Heritage Council of NSW Technical Advisory Group for Materials Conservation (TAGMAC).

9. Appendix A

Please see the attached file for the list of Syphons.