Cordeaux Dam

Instrumentation Project

Supporting Statement

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

Contents

1. Introduction

Cordeaux Dam is one of four large storage dams constructed throughout New South Wales in the period c.1910 to c.1920 for either urban water supply or rural irrigation purposes. The others include Chichester Dam for the Newcastle metropolitan supply, Cordeaux Dam and Avon Dam for the Sydney metropolitan supply, and Hume Dam for the irrigation supply of the Murray River Valley.

Cordeaux Dam has State heritage significance. This State significance is largely embodied in: the dam wall, inlet and outlet system, spillway and water body; the site layout; the construction terraces, tramway cutting and associated archaeological evidence; evidence of the construction camp and remaining buildings from the construction period; and the mid- twentieth century landscaping (Extent 2018).

The Dam requires regular monitoring and maintenance as prescribed under the *Dams Safety Act* 2015 and the Dams Safety Regulation 2019. Recent changes driven by the Regulation has seen Cordeaux Dam classified as a high risk dam. To monitor the dam and provide effective information WaterNSW has need to install various dam safety monitoring instruments at Cordeaux Dam.

2. Location

Cordeaux Dam is located 94 kilometres south of Sydney on Cordeaux River. The dam is located on the Cordeaux River upstream of its junction with the Avon River. The site is Lot14 DP1233164 and it is in the ownership of WaterNSW. An aerial view of the Dam is shown in Figure 1.

Figure 1 – Cordeaux Dam Aerial View

3. Heritage Listings

The following heritage listings apply to Cordeaux Dam:

Register	Listing Name and Number	Status
State Heritage Register	Cordeaux Dam (SHR 01360)	State
Wollondilly Shire LEP 2011	Cordeaux Dam I56	State
WaterNSW s170 Register	Cordeaux Dam 4580029	State

4. Heritage Significance, Site and Asset Description

The following is taken from the Conservation Management Plan (CMP) (Graham Brooks and Associates, 2003) and Conservation Management Plan (CMP) Update (Extent Heritage, 2018):

Cordeaux Dam is part of the Upper Nepean Scheme and derives some of its significance from its association with the Scheme, which is itself of State heritage significance. Completed in 1926, Cordeaux Dam was the second of the major dams to be built as part of the Scheme and as such has been a major part of Sydney's water supply for over 90 years. Cordeaux Dam was one of the major water supply/irrigation dams constructed in New South Wales during the first half of the twentieth century.

The wall of Cordeaux Dam is an engineering work imbued with a sense of high aesthetic values expressed through the long curved wall set within the valley of the Cordeaux River. The design and finishes of the crest houses, entry pylons and lower valve houses in the Inter War Egyptian style continue to demonstrate design philosophies of the day and the desire to evoke a romanticised vision of the 'Ancient Near East' at a time when many Australians had first hand experience of the area through military service and through knowledge of archaeological finds reported in the popular press. The care in designing the outward appearance of the Dam also demonstrates a sense of corporate pride and pride in the engineering achievements of the project. This site in particular is able to demonstrate the original form of the dam wall and the outlet system as both the dam wall and lower valve house remain largely unchanged without being obscured by the addition of considerable amounts of strengthening rockfill.

The design and technologies used in the construction of the dam are representative of methods developed at the time, for the construction of cyclopean masonry gravity dams by the Public Works Department of New South Wales. As the only four cyclopean masonry dams in NSW, the metropolitan dams collectively demonstrate developments in dam design and construction as a specialist branch of civil engineering. Cordeaux Dam incorporates innovations such as pressure grouted footings, inspection galleries, contraction joints, hydraulic pressure measurement systems and upper and lower outlets to reduce problems with intake vibration. The size of the masonry blocks in the dam wall continue to demonstrate the capacity of the construction cableways.

The dam wall and crest house where the works are to be undertaken have been assessed as having exceptional Heritage significance (Extent, 2018).

5. Scope of Works

WaterNSW has embraced a risk assessment approach to inform its decision making and to prioritise future investment as part of its Dam Safety Management Program. Cataract, Cordeaux and Woronora Dams all have societal risk ratings and/or highest risk ratings higher than the 'safety threshold' mandated by Dams Safety NSW. WaterNSW as a result is undertaking projects that will lower the safety risk.

The objective of the instrumentation upgrade project is to provide effective real time dam safety monitoring to allow early detection of potential dam safety threats. This will enable WaterNSW to reduce downstream consequences by improving emergency response in providing maximum possible warning times to our downstream communities in the event of an emergency to prevent loss of life in the event of any dam incidents.

The instrumentation upgrade will provide effective dam safety remote monitoring of key dam safety parameters such as movement or deformation, porewater pressure and seepage in near real time. This will aid in identifying potential dam safety threats (the potential failure modes); and detect the possible initiation/progression of a potential failure mode so that timely actions can be taken to prevent failure. The project will also provide real-time monitoring with alarm capabilities that will allow detection of significant changes in the performance or conditions of the dam that could otherwise go unnoticed.

It is imperative that WaterNSW enhance its monitoring regime in alignment with the risk profiles of Cordeaux Dam. In order to demonstrate due diligence WaterNSW must meet regulatory requirements in effectively managing dam safety risks, and the installation of monitoring systems is essential in meeting these requirements.

As part of the Instrumentation Project, various instruments will be installed at the downstream of the dam wall, on the dam wall and inside the Crest House. These instruments are listed in Table 1. The installation will include necessary cabling, dataloggers and data transmission between the instruments and WaterNSW's telemetry systems at Cordeaux Dam.

Instrument Type	Instrument ID	No.	Preferred Selection	Description	Connectivity
[redacted]					

Table 1 – Cordeaux Dam Instrumentation List.

V-Notch Weirs

This work involves replacing existing instruments. VG6 and VG7 are located in the lower dam gallery and measure flow from the left and right abutments respectively (Figures 2 and 3). VGALL is located at the gallery exit and measures the total seepage flow from all the V-Notch Weirs (Figures 2 and 3).

Figure 2 – V-Notch Weir Locations

Figure 3 – VG6, VG7 and VGALL V-Notch Weirs at Cordeaux Dam

The typical installation to replace existing V-Notch Weirs VL4 and VR2 are shown in Figures 4 and 5.

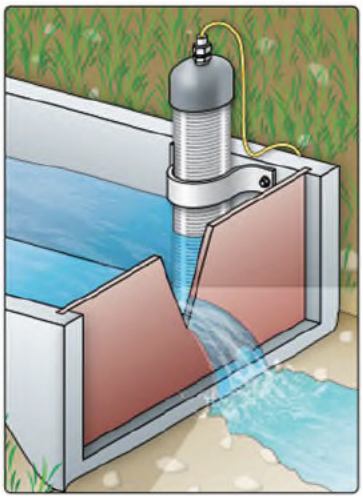

Figure 4 – Typical Geokon Model 4675VL sample

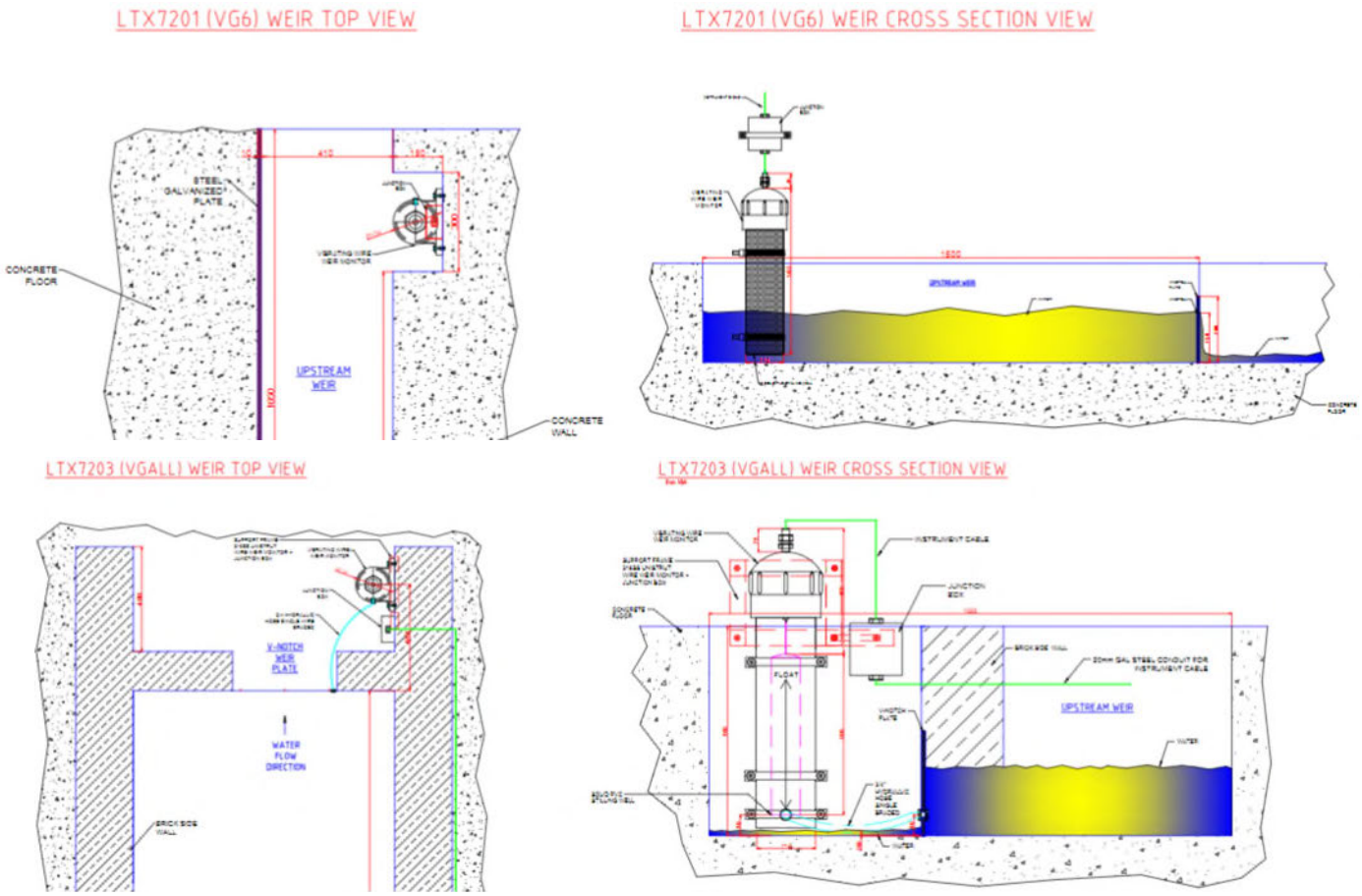

Figure 5 – VG6 (VG7 similar) and VGALL installations

This work will also include associated cabling works which will utilise combination of different methods:

- steel conduits and will be attached to the dam wall using metal Unistrut and saddles
- existing underground conduits inside the gallery
- attached to the stairwells

Cabling will be installed from electrical instrument and equipment mounted on the internal walls of the Crest House via existing underground conduits encased in the Dam Crest House and wall. A cable pit located immediately outside the Crest House Door connects to the bottom gallery with existing conduits. This will serve as the main cable run and then utilise existing cable tray to reach instrument locations in the lower valve house and galleries.

Tiltmeters

This work involves replacing existing instruments. Tiltmeters will continuously monitor any changes in tilt in both the upstream/downstream and left/right (cross valley) directions. Ten new tiltmeters will be installed at Cordeaux Dam. Tiltmeter locations of the tiltmeter installations are detailed in Table 2 and shown Figure 6.

Each tiltmeter will have the fastening of a mounting bracket to the dam walls and a protective casing around the sensor (Figure 7). The new digital tiltmeters are shown in Figure 8. The cabling installation will run via new and existing cable trays and conduits inside the galleries.

Dam	Tiltmeter Station
Cordeaux (Non-Submersible)	VB954, VD954, VF954, VH954, VJ954, V954, VM954
Cordeaux (Submersible)	VD854, VF864, VG865

Table 2 – Tiltmeter Stations at Cordeaux Dam

Figure 6 – Tiltmeter stations

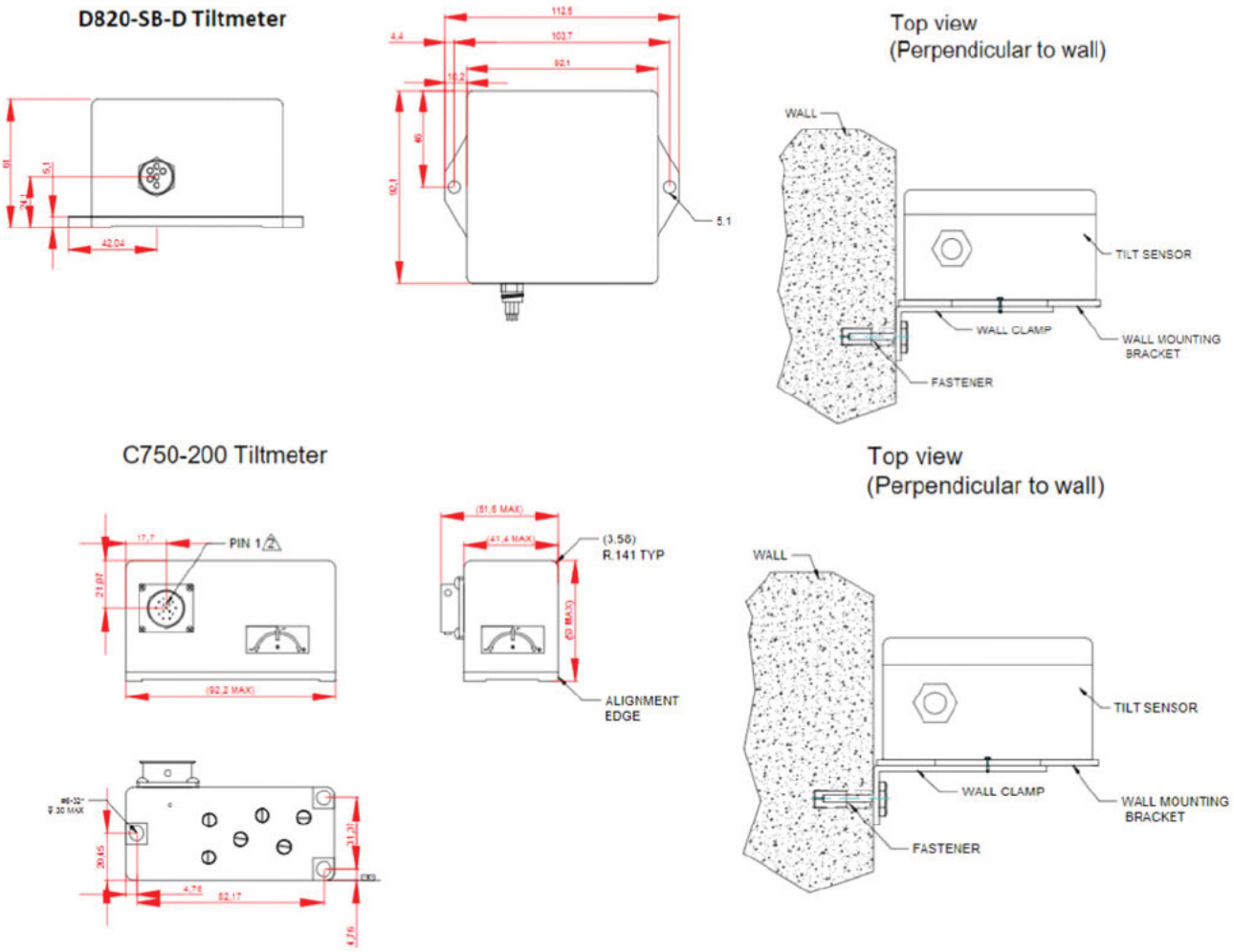

Figure 7 – Jewell D820-SB-D and C70-200 tiltmeters

Figure 8 – Jewell Model D820-SB-D (Submersible) and C750-200 (Non-submersible) Digital Tiltmeters

VW Transducers

This work involves replacing existing instruments. The instrument locations are shown in Figure 7.

Figure 7 – VW Transducer locations

The new instrument is shown in Figure 8. The cabling will be via existing cable routes.

Figure 8 – Typical Geokon Model 4500H

Strong Motion Sensors

Strong motion sensors will provide more reliable site-specific information following a seismic event. Four new strong motion sensors will be installed at the different locations (Figure 9).

Figure 9 – Four strong motion sensor locations (Orange colour) at Cordeaux Dam

The locations are provided in the Table 3 and general arrangement are provided in Figure 10.

Instrument	Location	Power Cabling
Dam Crest	A wall cabinet will be installed on the floor within the crest house on suitable space.	Via new cable trays within the Crest House.
Dam Abutment	A sensor will be installed on a suitable location on the Dam Abutment.	Solar powered. No cabling required.
Dam Toe / Gallery	A sensor on the Dam Toe/Foundation/Gallery will be installed outside the bottom gallery door.	Via existing cable routes within dam galleries.
Free Field in downstream	A free field sensor in the downstream zone at a distance away from the dam toe.	Solar powered. No cabling required.

Table 3 – Strong Motion Sensor locations and description

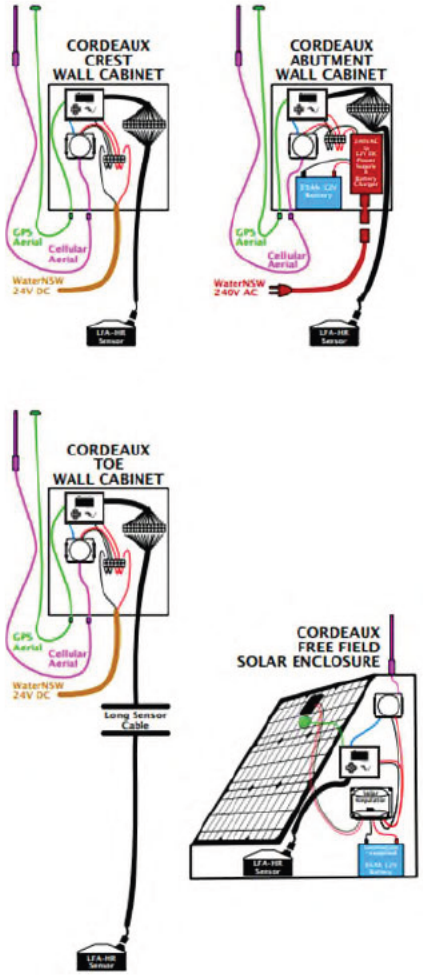

Figure 10 – Strong motion sensor general arrangement

The cabling will be installed using metal conduits on Unistruts and saddles to support. Conduit runs will be visually limited by drilling access holes where possible and in embedded corners where possible.

The strong motion sensors will be installed on a concrete pad (Figure 11).

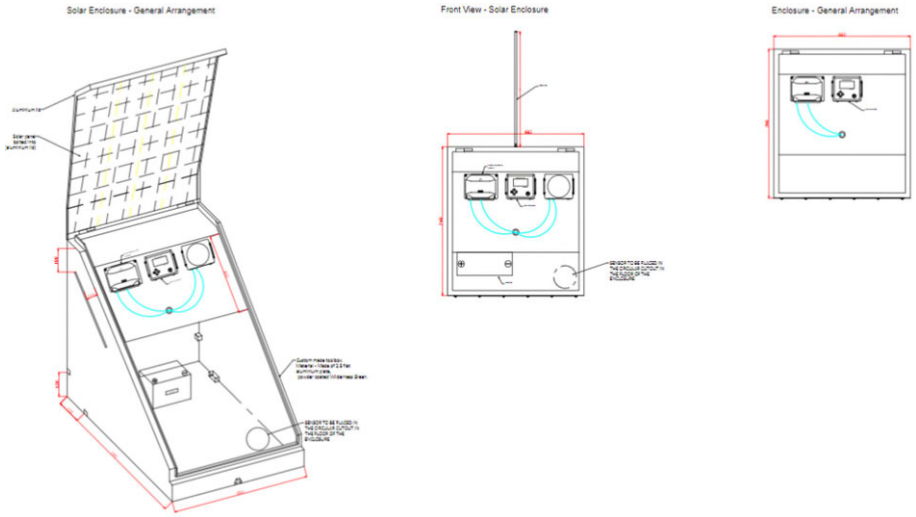

Figure 11 - Solar Enclosure with 740mm x 680mm dimensions

Datalogger and Barometer

A new datalogger and a new barometer will be installed outside the top gallery northern entrance door (Figures 12 and 13). The selected location is not visible from the Dam Crest when approaching the dam. Panel will be secured to the dam wall by two lengths of Unistruts.

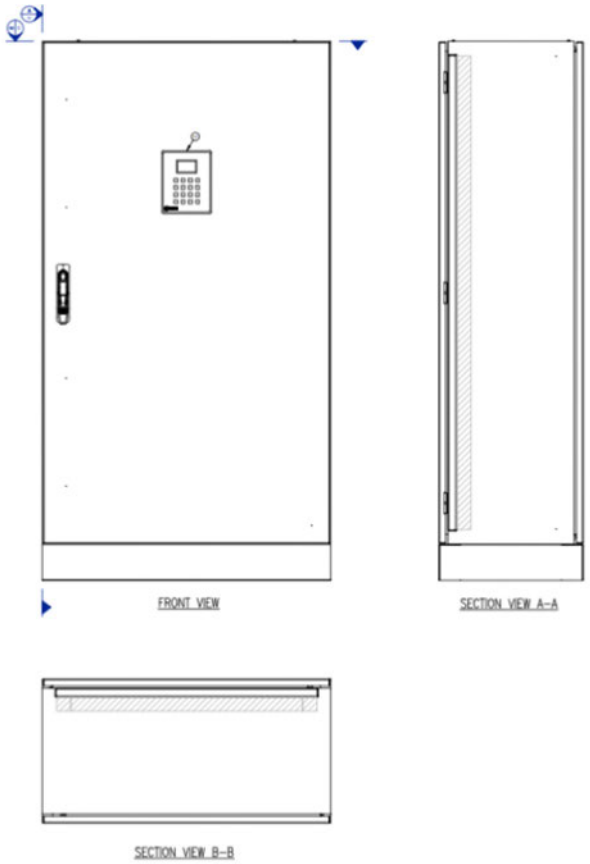

Figure 12 – A stainless steel datalogger panel with 2000H x 1000W x 400D (mm) dimensions

Figure 13 – Barometer

CCTV

Four new pan tilt zoom (PTZ) CCTV cameras will be installed at the dam wall and the downstream of the dam wall. The list of CCTV instruments is shown Table 4. The CCTV installations will also be accompanied by signage (either on a signpost, existing structures like the stairwell or on the internal of the dam wall) to notify staff and visitors that the cameras are present.

Item	Description	Make	Model	Dimensions (mm)	Weight
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]			[redacted]	[redacted]

Table 4 – CCTV Instruments

The location is marked up in Figure 14.

Figure 14 – CCTV locations

The right abutment installation design is shown in Figure 15. At the right abutment, a PTZ CCTV camera and IR Illuminator mounted on a swivel pole will be located to the right of the entry pylons. This camera and illuminator would be cabled to a switch in a supplied cabinet mounted on the pillar, using CAT6A and figure 8 cables enclosed in stainless steel conduit. An antenna will be installed on the southern side of the entry pylon on the downstream side. This is required to ensure the images being captured can be transmitted to monitoring equipment.

Figure 15 – Right abutment PTZ position and PTP antenna and cabinet

At the left abutment archway (Figures 16 and 17), a PTZ CCTV camera and IR Illuminator mounted on a swivel pole would be installed. These cameras and illuminators would be cabled to the walkway on the dam face using CAT6A and cables enclosed in stainless steel conduit. On the dam face walkway a cabinet would be installed to house a switch and 4G/5G router. This cabinet would be supplied with 240V power.

An aerial would be required on the northern side on the left abutment archway on the downstream pylon. This would be attached directly to the pylon.

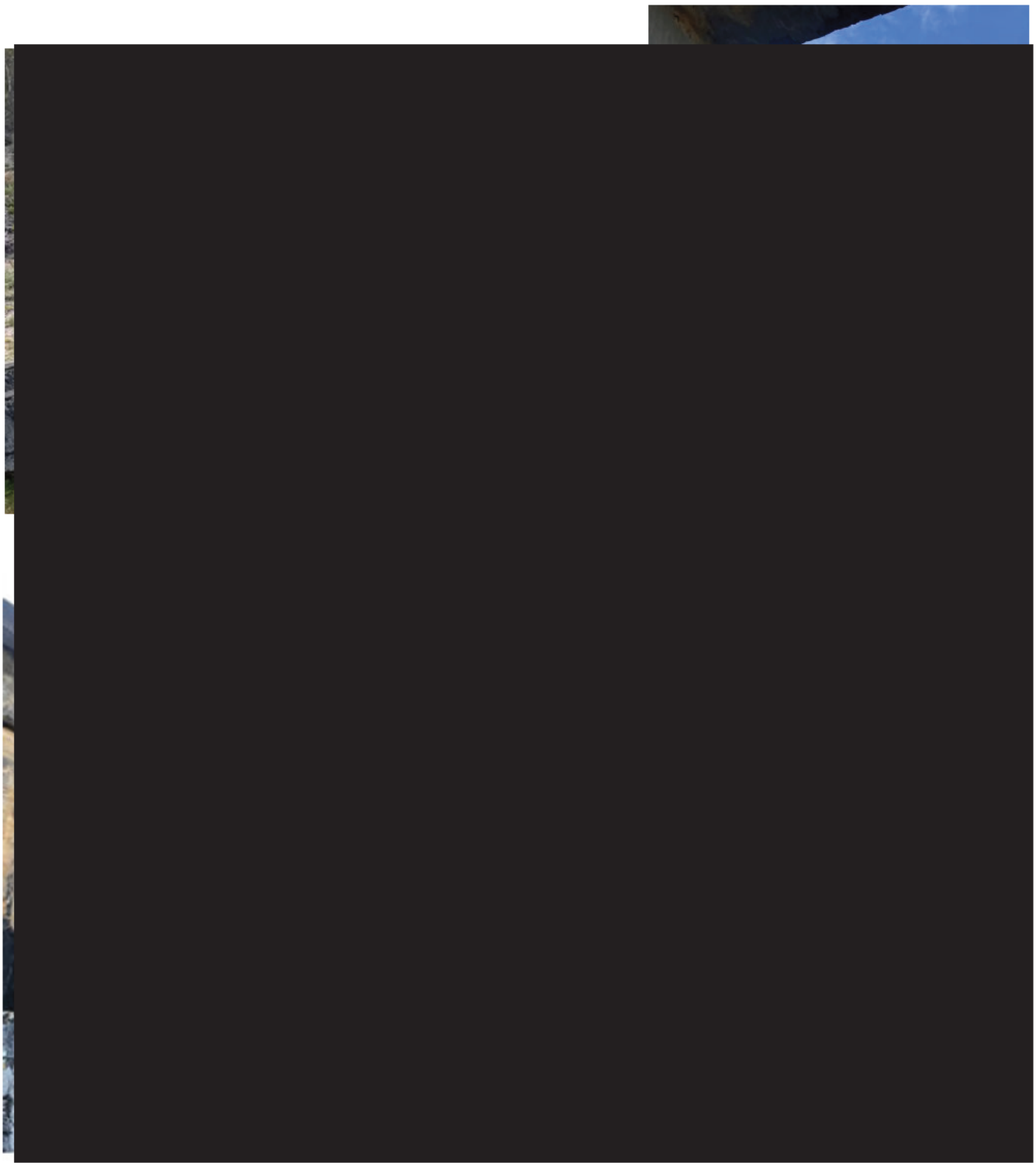

Figure 17 – Left abutment PTZ positions, left abutment looking at spillway, left abutment antenna and cabinet and Crest House antenna and cabinet

A Dome CCTV camera would be installed in the Lower Gallery at Block G (Figure 18). These would be cabled via optical fibre and figure 8 cables running to Lower Discharge Valve House.

Figure 18 – Lower Gallery Block GH Dome and cabinet

At the Lower Scour Valve House a PTZ CCTV camera and IR Illuminator would be mounted on a tilt pole installed on the outside walkway railing (Figure 19). The antenna will be installed to the roof of the lower valve house.

In the Lower Discharge Valve House these cables would terminate on a supplied network switch and DC power supply which are installed in a supplied cabinet. This cabinet would be supplied with 240V power. The network switch would then be connected to the WaterNSW network switch.

Figure 19 – VGALL PTZ camera and PTP antenna and lower gallery cabinet

WaterNSW will engage a Contractor to deliver the instrumentation upgrades. It is estimated the works will take 4 weeks to install and commission (weather permitting). The equipment will be brought to the site via existing roads. The contractor will place a transportable site shed at the north side of the existing WaterNSW site office. The lay down area will be behind this site shed.

6. Heritage Impact Statement

There will be no significant impact to Cordeaux Dam's overall heritage significance.

The Cordeaux Dam wall is rated as having Exceptional heritage significance, but the works will not detrimentally impact the significance of the structure. The installation of the new monitoring equipment is of a minor nature but is essential to the real time and long-term monitoring of the asset for dam safety purposes.

The installation of the equipment and associated electrical conduits has where possible used existing cable trays, cable pits and solar power to power this necessary equipment. The installations can be reversed and removed from the wall and other locations if not required in the future.

There is some minor visual impact with the installations of the three aerials required for the equipment to transmit the necessary monitoring data. In particular two aerials will be installed on the right entry and left pylons. The right abutment antennae will be installed on the southern side of the pylon to mitigate the impact to the Inter War Neo Egyptian style entry. The antenna on the left abutment is required to be installed on the northern side of the pylon to allow transmission from the monitoring devices which are on the walkway and steps below. It cannot be installed on the southern side as it will be over the spillway and access is difficult especially when spilling. The third antenna will be on top of the lower valve house roof but is some distance from the main wall viewing area and will not be prominent when viewed from the dam wall.

While this equipment is a new installation there is other monitoring equipment including survey equipment, survey pillars and markers already installed on the dam wall and in the general area. CCTV and associated equipment is becoming more common on public buildings and areas and is not out of place on public utility assets for monitoring purposes. The installations within the dam wall will not be visible to the members of the public visiting the dam wall for tourist purposes.

WaterNSW recently has a number of specific agency exemptions Gazetted. One of the exemptions does allow for the following to occur:

Installation, upgrading and or relocation of additional or existing seismic, tectonic, survey and other safety monitoring equipment/stations and power supply stations as part of the ongoing water storages and canal safety monitoring.

Due to the extent and number of the installations WaterNSW is of the view these installations do not meet the relevant standards of the Exemptions and has thus applied for a s60 fast track for these works instead of using the Exemptions. This will also make it consistent with the instrumentation activities already approved at Cataract and Woronora Dams before the exemptions were Gazetted.

7. Conclusion

The works to be undertaken will not have an adverse significant impact on the heritage item.
The works are the upgrading and installation of instrumentation needed to monitor Cordeaux Dam to enable WaterNSW to meet and mitigate NSW Dam Safety risk assessments. A s60 fast track approval is appropriate as the works are being installed onto the dam wall, galleries and crest house which are significant fabric, but installation cost is approximately $20,000. The works are essential to ensure the long-term monitoring and operation of the Dam.

8. References

Graham Brooks and Associates (2010) Cordeaux Dam Conservation Management Plan. Prepared for Sydney Catchment Authority (now WaterNSW).

Extent Heritage (2018) Cordeaux Dam Conservation Management Plan. Prepared for WaterNSW