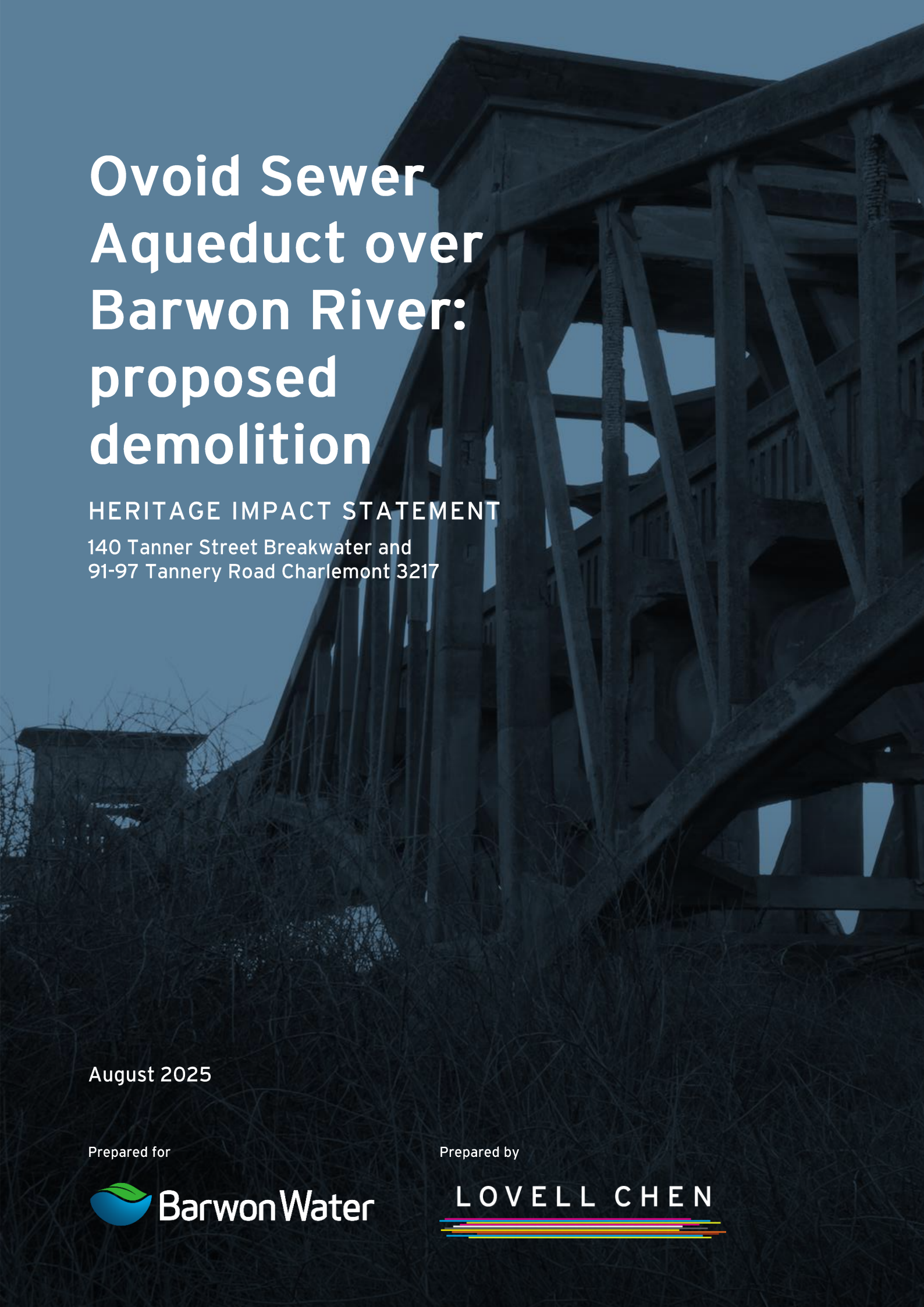

Ovoid Sewer Aqueduct over Barwon River: proposed demolition

HERITAGE IMPACT STATEMENT

140 Tanner Street Breakwater and
91-97 Tannery Road Charlemont 3217

August 2025

Prepared for

Barwon Water

Prepared by

LOVELL CHEN

ACKNOWLEDGEMENT OF COUNTRY

The Barwon River Ovoid Sewer Aqueduct stands on the lands and over the waters of the Wadawurrung people, who for thousands of years have been custodians of Country on lands extending from Ballarat to the Barwon Heads along Barre Warre Yulluk (Barwon River), the great river that runs from the mountains to the ocean.

We acknowledge Wadawurrung stories and connections to land, water and culture which are embedded in Country. We pay our respects to their Elders past and present and acknowledge that this report includes a post-contact history that forms only a small part of the ongoing story.

This report was prepared on Wurundjeri Woi-wurrung Country. We acknowledge the traditions and cultures of all Aboriginal and Torres Strait Islander people, and that sovereignty and stewardship of Country has never been ceded.

Quality Assurance Register

The following register documents the development and issue of this report prepared by Lovell Chen Pty Ltd in accordance with our certified quality management system.

Project no.	Issue no.	Description	Issue date	Approval
V8000.06		Final Heritage Impact Statement for Heritage Victoria application	26 August 2025	KG

Referencing

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Cover image Ovoid Sewer Aqueduct in 2019
Source: Lovell Chen archives

Next page Aqueduct spans (10 and 11) over river, photographed at completion c. 1915
Source: Barwon Water archives

LIST OF ABBREVIATIONS

ACC	Australian Corrosion Consultants
AHC	Australian Heritage Commission
CCMA	Corangamite Catchment Management Authority
CHMP	Cultural Heritage Management Plan
CRG	Aqueduct and Porronggitj Karrong Community Reference Group
DEECA	Department of Energy, Environment and Climate Action
ECI	Early contractor involvement
ESC	Essential Services Commission
HBC	Historic Buildings Council
HIMP	Heritage Infrastructure Management Plan
HIP	Heritage Interpretation Plan
HIS	Heritage Interpretation Strategy
SFAIRP	So Far As Is Reasonably Practicable
VHI	Victorian Heritage Inventory
VHR	Victorian Heritage Register
WGA	Wallbridge Gilbert Aztec
WIRO	Water Industry Regulatory Order
WTOAC	Wadawurrung Traditional Owners Aboriginal Corporation

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1.0 Introduction

1.1 Background

This Heritage Impact Statement (HIS) has been prepared for Barwon Water. The HIS accompanies a permit application under the *Heritage Act 2017* for demolition and associated works to the *Ovoid Sewer Aqueduct over the Barwon River* (hereafter 'the Aqueduct'), a Victorian Heritage Register (VHR) place (VHR H0895) that includes both a Registered Place and Registered Objects Integral to a Registered Place, extending across two separate locations:

- the Aqueduct structure and a portion of the land beneath and around the structure, as registered in 1992 (refer Figure 2)
- 'objects integral' to the place, consisting of roughly 40 moulds and gantries employed in the manufacturing of concrete sewer pipes [1] which are located at Marshall Railway Station and added to the registration through a 2023 amendment to the registration.

The heritage place (Figure 1 and Figure 2) is located at Breakwater, south of Geelong.

The Aqueduct stands over the floodplain of Barre Warre Yulluk (Barwon River), the great river that flows through the centre of Wadawurrung Country. Since 2018, Barwon Water has partnered with the Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) to advance ecological conservation, restore cultural landscapes and enable sustainable access to Porronggitj Karrong (The Place of the Brolga), a 66-hectare parcel of land and adjoining crown reserves to the east and west of the Aqueduct. This initiative is part of a broader vision to heal Country, celebrate Wadawurrung living cultural values, and reconnect the community with Barre Warre Yulluk (Barwon River) after more than 30 years of restricted access. This Cultural precinct re-establishes Wadawurrung custodianship and practices, with the project led by Wadawurrung Traditional Owners whose deep connection to Country, ancestral knowledge, and lore guide every decision. By opening the river corridor, it creates a vibrant space for community, Culture, and ecological restoration, honouring Wadawurrung ways of caring for Country and restoring the health of this living, life-giving entity. In October 2024 the Porronggitj Karrong project was honoured with an Organisational Excellence Award at the Australian Water Association's 2024 Victorian Water Awards.

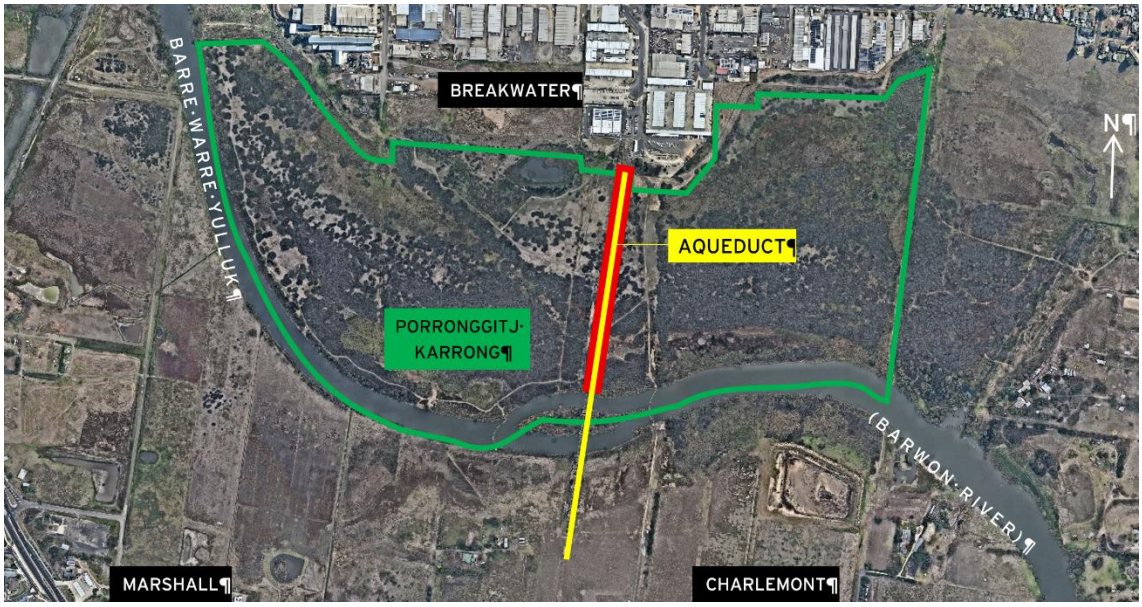

Figure 1 Location plan with Aqueduct (yellow) and registered land (red), Porronggitj Karrong cultural precinct (green) and surrounding suburbs shown indicatively
Source: (base map) Nearmap, 16 April 2025 capture date

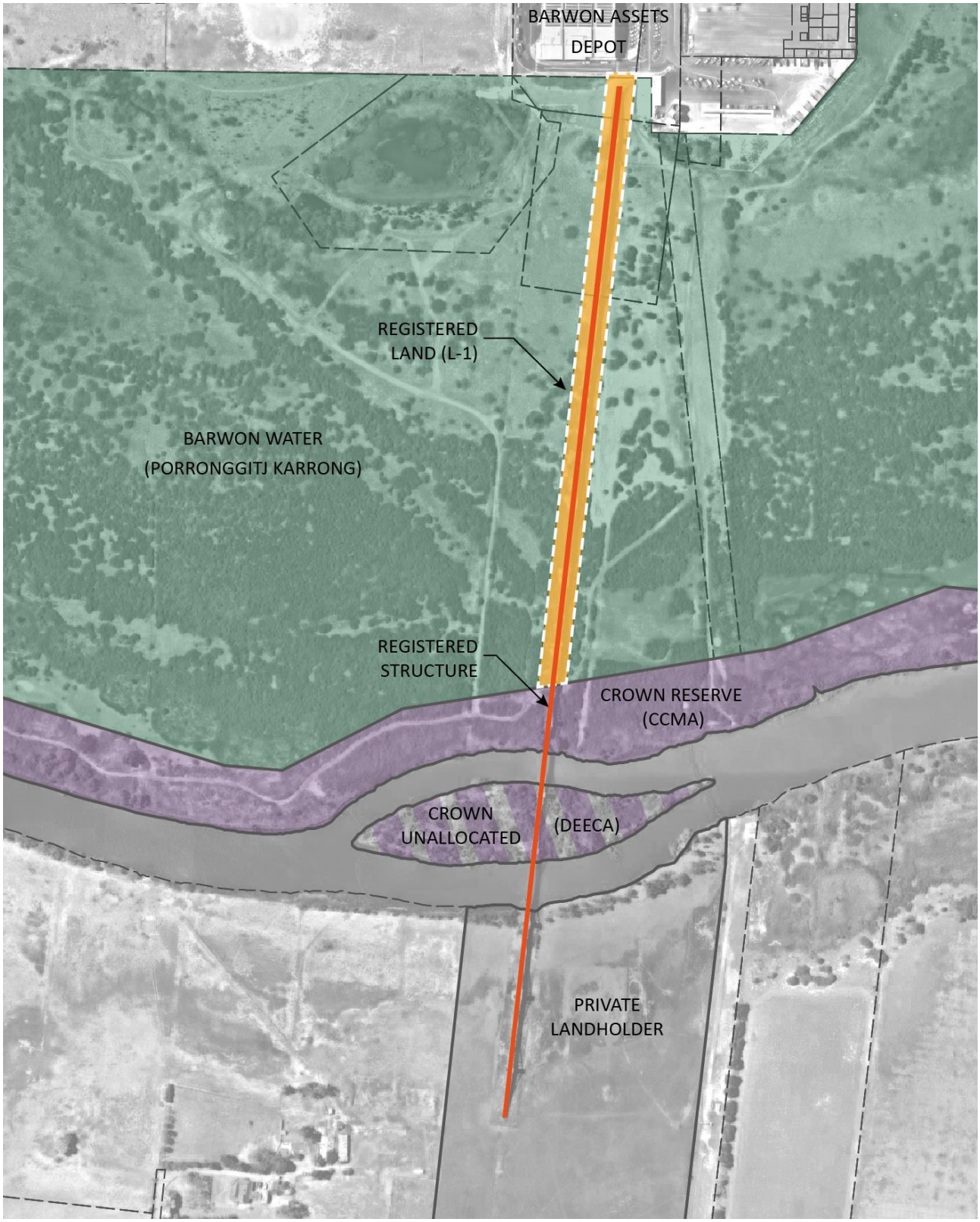

Figure 2 Barwon Ovoid Sewer Aqueduct, VHR registered extent and land ownership
Source: Base imagery from Nearmap

Project history

The permit application for demolition follows the issue of an earlier Heritage Victoria permit for the partial demolition of the Aqueduct (Permit P32806, issued 16 November 2020 and amended on 2 March 2022, 20 January 2023 and 21 October 2024, see Appendix A). That permit approved demolition of four of the structure's 14 truss spans, located over the two channels of the river, conditional on the installation of permanent structural propping and implementation of other associated works and undertakings including a heritage interpretation program.

The intent of the permitted works approved in 2020 was to achieve the reopening of the river and adjoining northern bank of the floodplain for both the public and the Wadawurrung Traditional Owners, with whom Barwon Water has partnered to support ecological restoration and renewal of Wadawurrung living cultural values within a cultural precinct called Porronggitj Karrong (Place of the Brolga). For safety reasons, land beneath the structure has been off-limits since 1992, and both river channels have been closed at the Aqueduct since 1995. Alongside the reopening, the permit established a requirement for works and measures to reasonably prevent a catastrophic collapse of the structure, centred upon installation of permanent structural propping to reduce collapse risks.

Following extensive design investigations and risk assessments, Barwon Water has determined that it is unable to safely implement the requirements of the 2020 heritage permit (including the required permanent propping). The risks to public and occupational health and safety relate not only to the works themselves, but would remain in the longer term for the retained parts of the structure. The previously approved scope of works is therefore not feasible and cannot be implemented having regard to the organisation's obligations under the *Occupational Health and Safety Act* (OHSA) and the *Water Act*, among other statutory legislation and regulations. These considerations are reviewed in future detail in the heritage impact assessment in this report.

New permit application

In summary, the new permit application seeks approval for the following works:

- Full demolition of the principal structure of the Aqueduct, including all 14 truss spans
- Retention of physical 'footprint' elements to form part of a future heritage interpretation strategy:
    - two stair landings at each end above where the pipe exited and re-entered the ground
    - fourteen pier base structures below the demolished piers
    - opportunistic salvage of sewer pipe sections
- Implementation of an Aqueduct Heritage Interpretation Strategy, including new physical works and elements within the place.

Barwon Water has prepared a detailed position statement (refer to Annexure C) which describes the organisation's considerations in its decision to undertake this new application, including:

- Rationale and objectives for the project
- Risks to worker and public safety, and investigations undertaken in seeking to mitigate these risks
- Barwon Water's responsibilities to ratepayers and its statutory duties of care.

A summary of relevant aspects of the current project's history is included in this HIS at Section **Error! Reference source not found.** and Section 3.2. More information is provided on these issues at Section 5.2 (reasonable and economic use) and Section 5.3 (duties of a public authority).

1.2 Documentation for approval

The following documentation describes the works for which approval is sought:

- Barwon River Ovoid Sewer Aqueduct Demolition Works (Arup, P1 issue, 07/07/2025, 5 sheets)

- Heritage Interpretation Strategy (Lovell Chen, August 2025).

1.3 Supporting documentation

The following supporting documentation accompanies the application and has been referred to in the preparation of this Heritage Impact Statement:

Document title
Annexure A - Engineering report Barwon Aqueduct Structural Engineering and Risk Assessment (Arup, 28 August 2025)
Annexure B - Engineering peer review report Barwon Ovoid Sewer Aqueduct (StructexAu, 15 April 2025)
Annexure C - Owner's position statement Barwon Water Position Statement (Barwon Water, August 2025)

1.4 Community and stakeholder engagement

As detailed in the Barwon Water Position Statement (Annexure C), the organisation has undertaken extensive community and stakeholder engagement since the original permit was issued in 2020. This has included various public outreach activities, establishment of the *Aqueduct and Porronggitj Karrong Community Reference Group* (CRG), engagement with the longstanding Barwon Water Customer Advisory Committee, and ongoing liaison with state and local government leaders, local members and councillors, public authorities and regional organisations, and Traditional Owners.

The CRG is an advisory group established by Barwon Water in partnership with WTOAC; membership has been drawn from interested community members and identified stakeholder groups, including Geelong Sustainability, Geelong Field Naturalists Club, Geelong Environment Council, Friends of the Barwon River, Geelong Canoe Club, National Trust of Victoria, National Trust of Victoria – Geelong branch, Friends of the Barwon River Ovoid Sewer Aqueduct and Engineering Heritage Victoria. Since late 2021 the CRG has met on 15 occasions, receiving briefings, participating in workshops and providing feedback addressed to project developments, heritage interpretation and cultural precinct planning, including Barwon Water's recent considerations and decision to proceed with the current application. Following determination of the application, it is intended that the CRG will continue to meet and inform delivery of the proposed heritage interpretation programme as well as other activities at Porronggitj Karrong.

Wadawurrung people are partners with Barwon Water in developing a joint vision for long-term stewardship of Porronggitj Karrong, as well as initiating healthy country planning, ecological restoration and renewal of traditional cultural activities within the precinct over the last eight years. Barwon Water regularly consults WTOAC on matters affecting the future of the precinct and the Barre Warre Yulluk waterway, including engagement on aspects of the current proposal such as proposed retention of structural elements, joint storytelling opportunities and how the site of the Aqueduct can be cared for and valued in future should the current proposal be approved and implemented.

Barwon Water has provided a more detailed summary of community consultation – refer to the Barwon Water Position Statement (Annexure C). This summary noted that concerns have been raised from heritage groups in relation to the Aqueduct, but more generally there is feedback across all engagement from Barwon Water customers, communities and stakeholders in positive support of the safe management of the Aqueduct structure and future public opening of the 66-hectare land parcel surrounding the structure.

1.5 Heritage Victoria engagement

Barwon Water liaised regularly with Heritage Victoria throughout its efforts to implement the 2020 heritage permit. This included satisfaction of initial pre-commencement permit conditions, approval of a series of permit amendments, and detailed engagement on the risk assessments and constructability investigations that have ultimately informed the decision that the original permit could not be implemented.

Beginning in late 2024, a number of pre-application meetings with Heritage Victoria were held to discuss the revised proposal and the application.

Figure 3 Oblique aerial view of the Aqueduct looking north-west from Truss #14, south of the river
Source: Courtesy Barwon Water

Figure 4 Oblique aerial view looking directly south along the length of Aqueduct from Truss #1
Source: Courtesy Barwon Water

2.0 Ovoid Sewer Aqueduct

2.1 The heritage place

The Aqueduct is a 756-metre, multi-span bridge constructed of reinforced concrete using experimental methods. Erected between 1912 and 1915, the Aqueduct contains 14 symmetrical truss spans (Figure 3 to Figure 6) in a balanced cantilever arrangement to carry the Geelong Outfall Sewer ovoid pipe across the river and floodplain at Breakwater.

Designed and built by the partnership of Edward Giles Stone and Ernest J Siddeley, the Aqueduct was constructed to a design widely recognised as having been inspired by the so-called 'coathanger trusses' of the Forth Railway Bridge (1890) in Scotland, a multi-span balanced cantilever bridge of steel construction. The Stone & Siddeley Aqueduct's application of reinforced concrete construction to the Forth Bridge's open framed web truss design and balanced cantilever arrangement was considered unusual at the time and rarely repeated. Their design promised unparalleled structural capacity and aesthetic qualities at a lower cost than more conventional structural designs, and was selected by the Geelong Water and Sewer Trust's lead engineer on that basis (Section 2.2).

As constructed, many of the Aqueduct's structural members employed an unusual wire-bound reinforcement method invented by French engineer Armand Gabriel Considère; while certain tension members within the structure used earlier concrete reinforcement techniques popularised by another French engineer, François Hennebique.[2] Stone & Siddeley were independently minded entrepreneurs and inventors; Stone also developed his own concrete mixes based on what he reported were exhaustive tests. Their use of the French systems was responsive to the forces in the web truss they designed, and may also have been seen as a means of bypassing patented systems with stringent Australian representation, like the Monier system widely employed in bridges of the time. Stone & Siddeley's use of the Considère system is not known to have led to lasting commercial interest or adoption elsewhere in Australia.

Each of the 14 spanning trusses of the Aqueduct comprises a matched pair of triangular web trusses hung from a central open pier tower which stands on precast concrete piles driven to bedrock. In addition to the trusses, the structure of the Aqueduct includes the segmented walkway, ovoid sewer pipe and pipe hangers. Within each truss span, these elements are supported by the symmetrically balanced truss, while beyond the end of each truss the walkway is reinforced to serve as a bridging girder of varying length. The ovoid pipe segments and octagonal piles were precast at the firm's nearby Marshall pipe factory, while the trusses, piers, walkway and pipe hangers were assembled and cast-in-place using a reusable concreting gantry and extensive temporary forms and scaffolding.

The Aqueduct's trusses contains more than 896 discrete concrete elements (64 main truss elements at each of the 14 piers, with additional lateral elements). These concrete truss elements serve in concert to carry the loads on the structure. Within each compression element, the Considère reinforcement was a bundle of steel bars bound by spiral wire carefully wound around their exterior; in comparison to conventionally tied and welded reinforcement, this approach was considered to increase the compressive strength of the reinforced concrete core (the load bearing section of the element), sustaining loadings within a lightweight (and thus inexpensive) structure that was impossible to achieve with other systems. Many of the truss elements are narrow, with a very thin concrete cover (often less than 60 mm) which did not conform to construction standards of the period, let alone those practiced today. This has been a factor in the advancing degradation of this concrete structure, which has occurred progressively since its construction (Figure 7 and Section 2.3).

In Heritage Victoria's Statement of Significance for the place (updated in 2023), the heritage place is described as:

> The Ovoid Sewer Aqueduct, designed and constructed by the Tasmanian engineers Edward Giles Stone and Ernest J. Siddeley, and constructed in 1913-15 for the Geelong Waterworks and Sewerage Trust. Objects integral to the manufacture of the concrete sewer pipes, including various moulds and gantries, are still in place at the former factory site nearby, adjacent to Marshall Station.

The reasons for significance are summarised at the outset of the heritage impact assessment in Section 5.1.

Figure 5 View to the Ovoid Sewer Aqueduct from Kadak Place, Breakwater
Source: Lovell Chen archives, photographed 2019

Figure 6 Typical pier and truss span; upper chord and diagonal web members are held in tension, while the lower chord and vertical web members are subject to compression forces
Source: Lovell Chen archives, photographed 2019

Figure 7 Example of advanced degradation of an upper chord and adjoining vertical members and crossbeam
Source: Lovell Chen archives, photographed 2019

2.2 History of the Aqueduct's design, tendering and construction

As noted above, the Aqueduct was a critical element in the Geelong Sewerage Scheme, designed to carry the Geelong Outfall Sewer uninterrupted across the Barwon River floodplain so that wastewater pumped into the sewer would flow by gravity all the way to an ocean outfall at Black Rock, east of Breamlea. The scheme was funded by the Geelong Water & Sewer Trust, which raised construction loans totalling £375,000 (roughly $50 million today), and designed by the Trust's Chief Engineer for Sewerage R T McKay, who had been recruited from the NSW Public Works Department.

In 1912, McKay called tenders for the design and construction of the Aqueduct, specifying its location, multi-span arrangement, minimum span length (30 metres / 100 feet), and the dimensions and loading of the outfall sewer. In evaluating the tenderers' designs, McKay reported he had considered not only costs and performance, but also that

> Not only must the structure be of a perfectly stable character, but in view of the permanence and importance of the work it should also possess symmetry and attractiveness in design.[3]

Eight tenderers submitted proposals, employing various structural designs and materials, including steel and reinforced concrete. Stone & Siddeley's selected design was the only balanced cantilever proposed, and was the lightest, and least expensive of three alternative schemes submitted by the firm (tendered at £18,000, $2.69 million today). Recommending the selected design, McKay suggested that:

> The completed structure would stand out as the best and longest of its kind in Australia, and one of which the district might well be proud.[4]

McKay also reported his own calculated cost to excavate a siphon below the river, concluding this less expensive (£15,000) but ultimately more costly to operate and maintain than Stone & Siddeley's Aqueduct, for which he suggested 'the maintenance would be practically nothing, and no attention need be devoted to it once it is built.'[5]

Stone & Siddeley had by this time won several of the Trust's contracts to supply and install concrete sewer pipe along the route of the outfall sewer (Figure 8) and in June 1912 had opened a temporary factory at Marshall and a construction tramway to deliver precast pipe along the length of the sewer trenching works. Methods developed by Stone & Siddeley at the pipe factory were at least as innovative as their adventurous design for the Aqueduct; the factory was widely lauded by the press and the process successfully patented in Australia and the United States. In early 1913 the factory produced precast concrete piles (Figure 9) which would be driven into the bedrock below the floodplain at Breakwater to anchor the central piers of the Aqueduct's fourteen cantilevered trusses.

The Aqueduct itself was constructed using cast in place concrete, with steel reinforcing bars and the Considère system binding wire assembled in place within timber formwork. A number of photographs of the construction process exist, showing the large-scale gantries, scaffolding and formwork used to erect the structure. Despite various industrial disputes, the Aqueduct was substantially completed by June 1915 and entered service in July 1916. In June 1917 the sewerage system was finished, and McKay resigned to return to NSW, his job apparently complete.[6]

Some 75 years later, engineers at Taywood-Mausell would review the Aqueduct's design with fresh eyes, identifying that 'The main initial flaw as far as durability is concerned is that the structural efficiency of the design required a concrete with a compressive strength of only 14 MPa. As a guide, a 20 MPa concrete will generally have poor durability characteristics, 32 MPa will have acceptable characteristics and 45 MPa will perform well in most circumstances.'[7]

While the 14 MPa figure was later disputed,[8] the concrete was nonetheless of relatively low strength and this affected its physical durability and that of the steel below it. This was exacerbated by Stone's opinion of the depth of concrete required, and McKay's optimistic evaluation of concrete's longevity and privileging of aesthetics and cost; the design met his demanding load requirements while being far cheaper to construct than its competitors. The 'success' of the Aqueduct's design ironically led its designers and the Trust to accept specifications and faulty materials that would have been intolerable in any other system, faults which made repairs increasingly impractical in comparison to conventional structures and eventually compromised the Aqueduct's operational use and prospects for retention.

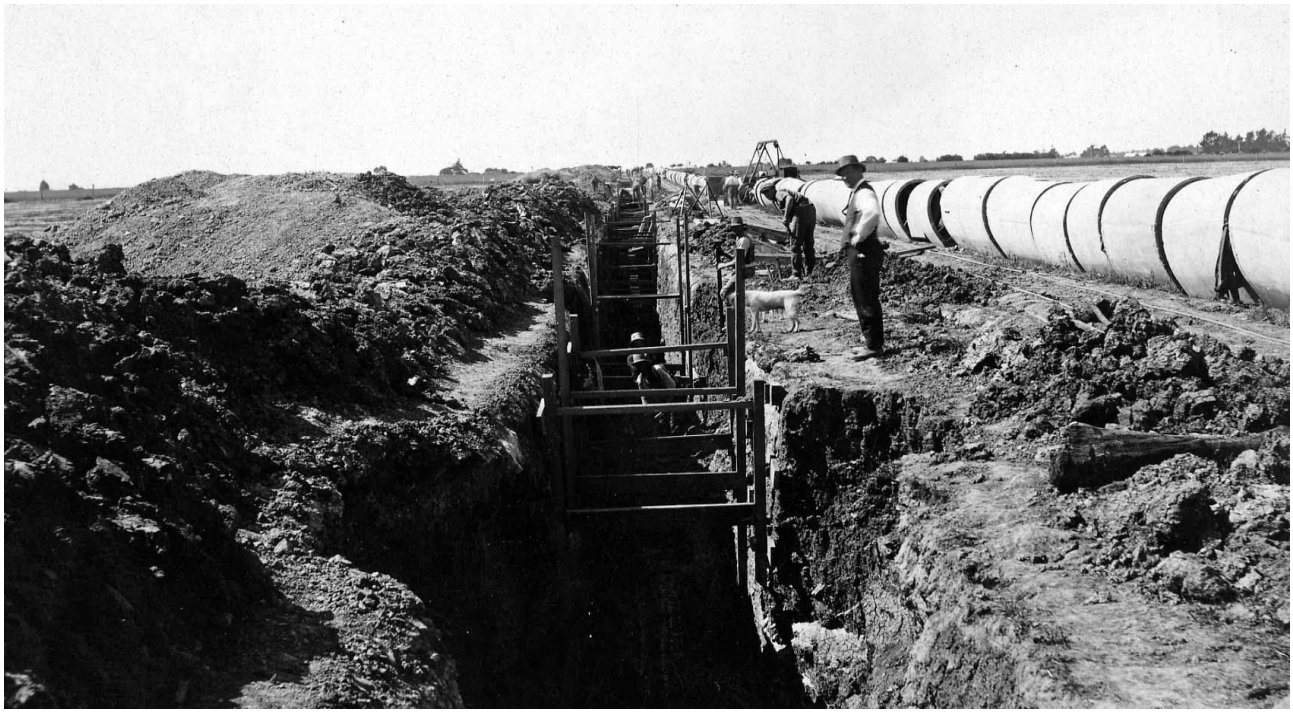

Figure 8 Trenching for the installation of the Geelong Outfall Sewer, c. 1912-1914, with ovoid sewer pipe manufactured by Stone & Siddeley lined up alongside the trench for installation
Source: Barwon Water archives

Figure 9 Manufacturing of Aqueduct's precast concrete piles at Stone & Siddeley's Marshall Pipe Factory, 1913
Source: Barwon Water archives

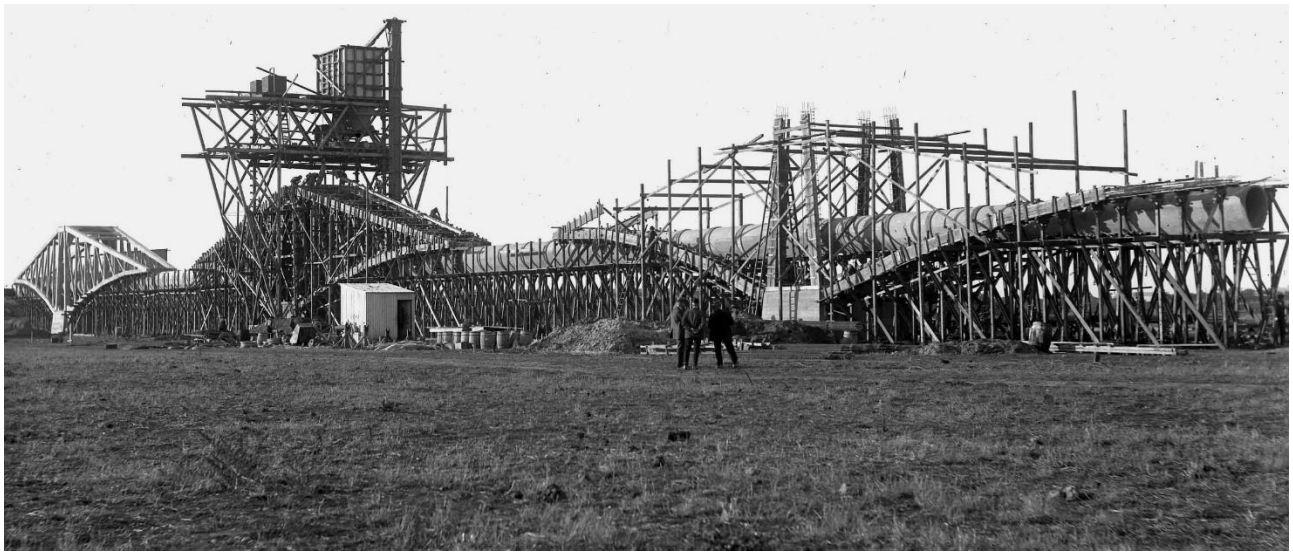

Figure 10 Construction sequence photograph showing (right) temporary scaffolding and erection of steel reinforcement and timber formwork; (centre left) completed truss formwork and concreting gantry; (far left) completed concrete web truss (prior to capping of pier tower)
Source: Barwon Water archives

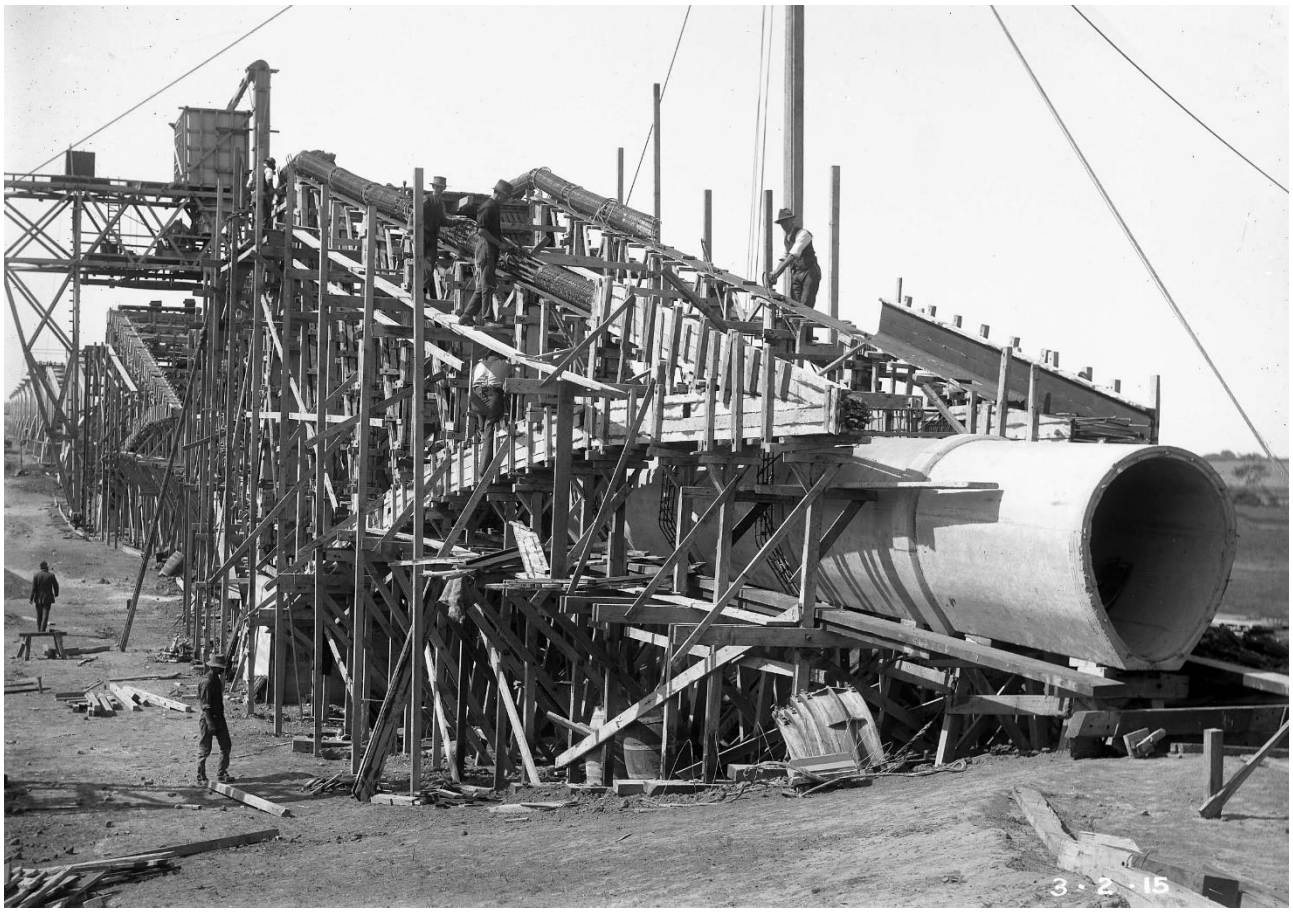

Figure 11 1915 photograph showing assembly of steel reinforcement and timber formwork around the ovoid pipe at the north or south end truss
Source: Barwon Water archives

2.3 History of physical condition issues, investigations and repairs

Material and structural issues were discovered almost immediately following the completion of the Aqueduct.

1922-1924 rehabilitation project

In June 1922, the Trust's staff surveyor Charles Breen reported to McKay's successor, chief engineer James Sharland:

> You are aware for some time past cracks have been noticed in the concrete work of the structure. On 15th May Mr Cosgrove verbally reported that one of the tension members near the northern end 1st span, west side had cracked badly and a piece was so loose that as he touched it it came away…
>
> When I called your attention to the fact you arranged for a personal visit… We found that many of the tension members showed cracks, some very slight, others more serious.
>
> The reinforcement in many cases was visible and showed rust and consequent expansion from oxidisation which would appear to be the cause of the material cracking.
>
> The compression members appeared to be quite sound. On examining the detail drawings of the work, I found that the reinforcement was much nearer to the outside of the concrete in the case of the tension than in that of the compression.
>
> The relative spaces between the metal and the outside of the concrete is 7/16" in tension and 12/16 for compression. In looking through the London County Council Regulations for Reinforced Concrete Construction Rules 138-143, the minimum cover allowed is 1", except in case of slabs where 1/2" is the minimum.
>
> It would appear that the atmospheric effects on the metal due to insufficient cover may have caused the trouble.[9]

The Trust responded by commissioning further reports, first from Melbourne-based Consulting Engineer J A Laing and later from Edward Stone himself. By July 1922, Laing had reviewed the situation, noting that the cantilevered design was 'comparatively rare in its application to reinforced concrete' and reporting that:

> The protective covering of concrete over the reinforcing bars in some of the members of the trusses is not more than 1/2" … The protective covering of concrete over the reinforcing bars in the truss members should be at least 2" in a structure of this kind… the comparatively slender members of the trusses in their exposed positions afford each other little or no protection…
>
> The primary cause of the trouble is that the thin protective covering of concrete provided has allowed ordinary small surface hair cracks to open up down to the reinforcement exposing the steel bars to the action of the weather… this condition is considerably aggravated in tension members owing to the slight elastic stretch of the steel tending to open the cracks… as soon as any portion of the steel is exposed to the weather rust will form locally – the oxygen of the air combining with the surface steel. This chemical reaction causes an increase in bulk, and this swelling action as the rust develops, gradually loosens small pieces of the concrete, leaving the steel more exposed than before, so that the action is progressive.[10]

Laing recommended a further covering of cement mortar be applied to all the truss members, suggesting the newly invented cement gun could be used for this purpose; in the meantime, he recommended cement grout be applied to all existing cracks. Sharland reported that he later met with Stone in Melbourne:

> I mentioned there was not sufficient covering of concrete. In some places in the struts the concrete covering the reinforcement is only ¼ inch to ½ inch thick. As the locality was a bad one on account of the salt air coming from Connewarre Swamps, something would have to be done… Mr Stone said ample reinforcement had been provided throughout of the best English steel and

> that the structure was safe in every way so far as design and construction were concerned… he said that some neat cement should be put in all exposed places. I said in my opinion the width of the struts should be increased from 6 inches to 8 inches, so as to give ample covering… Mr Stone said he did not think that would be necessary, probably a ½ inch coat would suffice, and the stopping with neat cement might get over all the trouble…[11]

Stone was later engaged to provide a report; furnishing inspection findings and follow-up estimates and sketches in August and September 1923. By this time, there was more evidence of corrosion, even on vertical pier legs afforded a nominally regulation depth of concrete cover, and on the balustrade. Here Stone was most concerned due to the balustrade's importance as a girder, reporting it had 'suffered severely and is not… as it now stands sufficiently stable;' several deflections in the girder had been discovered[12] and another was identified on Stone's return in November.[13]

Stone blamed unsound cement supplied to the project by a local company, but agreed that action was required 'as quickly as possible' as he considered some of the affected members to be of greater structural importance. He recommended re-coating the web trusses to a greater depth and repair of the girder balustrades with additional reinforcement and concrete, but he continued to insist that only 1/2" [13mm] of new concrete was needed. Stone stressed that with a rough cast finish to the repairs, 'the appearance of the structure will not be affected, in fact will be even finer as at present;'[14] for the expenditure of £3,262 ($323,270 in 2024 dollars) he promised that 'the condition of the Aqueduct… will be perfectly sound in every way.'[15] On 2 October 1923, the Trust wrote Stone to accept his offer.

McKay, now Secretary of the Sydney Harbour Trust, exchanged correspondence with Sharland on various matters throughout the repair project. Reviewing progress photographs sent to him in early 1924, McKay observed that 'the photographs show that the repair work was of a somewhat extensive character. It is certainly much more so than I anticipated. Apparently you found it necessary to strip almost completely some of the small diagonal members.'[16]

Sharland's internal memo dated 28 March 1924 summarised the repair programme as it was nearing completion:

> Operations are being continued steadily with repairs to the aqueduct. The raising of the girders and spans is completed and most of the timber supports have been removed… the reinforcing, concreting and gun work, etc., on the girders should be completed in about a fortnight. On a number of the spans it was found necessary to extend this work along the parapet for two or more panels on each side of the girders, as the existing concrete was found on examination to be badly cracked. The patching of the cantilever members has also been going on, eight of the fourteen spans being completed. I anticipate it will take another four or five weeks to finish this work. All these operations have made it necessary to use a considerable amount of scaffolding.
>
> Consideration has been given to the question of cement rendering or painting over the whole of the structure. To undertake this work would be costly... Attention by patching when or wherever blistering is apparent should be all the work required on the structure for some years… This means that two or three men every few months will have to inspect and attend to any apparent defects.[17]

Sharland's final report was provided on 30 May 1924. All of the 14 truss spans had had loose concrete broken away and patched, with many of the diagonal web members completely recast. All girder spans had been raised 3/4" [19mm] using jacking and timber trestle supports prior to recasting of the balustrades, where roughly 600 metres had been stripped, reinforced and reconcreted.[18] Works similar in scope to those described are shown in two digitised black and white photographs from Barwon Water's archives (Figure 12), which show scaffolding and extensive fallen spalls removed manually from the structure, and a repair underway on a vertical truss member.

Sharland wrote Stone the same week, complementing the work of Stone's foreman and projecting that 'Beyond a little blistering which may appear here and there on the concrete, and which can be attended to from time to time, I

do not anticipate that we shall have any further trouble with the structure.'[19] This proved optimistic; Breen's 1930 inspection recorded 122 newly cracked truss members across the Aqueduct.[20]

1950s-1980s repair programmes

In 1957-1960, a major programme of repairs and truss member reconstruction is known to have been undertaken at a cost of more than £20,000[21] (the equivalent of $786,000 today); a design drawing has been located in Barwon Water's archives which shows temporary bracing used to unload the diagonal web truss members during these works.

In late 1974, the Trust's new Chief Engineer GJG Vines briefed the Trust's Secretary on his first 'cursory inspection' of the Aqueduct, reporting he was 'most disturbed at the general deterioration of the structure. It is evident that urgent measures must be taken to effect temporary strengthening to certain parts of the structure, particularly compression members.'[22] Vines ordered temporary timber struts and props installed immediately to prevent failure.

In 1977, Vines identified urgent repairs to 23 vertical truss members and patch repairs elsewhere, suggesting 'there is little doubt that the concrete in the bridge is deteriorating at an increasing rate and that progressive repair work may only increase the life of the bridge by up to 10 years.' He received immediate authorisation to tender repairs at an estimated cost of $50,000 ($350,000 today), and begin investigations to design a replacement.[23] The Trust Secretary paraphrased to Vines the deliberations of the Trust's commissioners:

> considering inflationary trends it would be best to face up to the problem of replacing the existing structure as soon as possible rather than embarking on a programme of continual repair. Whilst this was generally agreed to… some years must elapse before a new structure, which might cost in excess of $1 mill. [$6.85 million today] could be decided upon, investigated and financed, and running repairs were essential in the intervening period.[24]

Those running repairs are known to have continued. The Register of the National Estate entry included in the Australian Heritage Database notes that shotcrete repairs were undertaken in 1977, 1979 and 1980. Further works in 1984 (Figure 13) included concrete stripping, reinforcement and recasting of sections of top and bottom chords on six of the trusses, recasting or patch repairs to vertical and diagonal web members and pier legs, and repairs to pipe supporting beams, handrails and gussets, at a cost of around $500,000 in today's dollars.[25]

By the late 1980s, the then-Geelong and District Water Board had resolved a plan to route the outfall sewer around the Aqueduct. A new pump-assisted gravity siphon was to be tunnelled below the river to the east, replacing the hazardous bridge section. Once completed, the Aqueduct could be removed from service and decommissioned.

1990-1992 emergency works, assessments and replacement

In the 1980s, the Aqueduct was the subject of initial heritage listings in the Geelong Regional Planning Scheme and the (now defunct) Register of the National Estate. Assessed in the Geelong heritage study as of state significance, by early 1991 the structure was formally nominated to Victoria's Historic Buildings Register (now the VHR).[26]

Alongside this nomination, the Trust's engineers were grappling with the reality that even recent repairs had generally been insufficient to stop ongoing corrosion of the Aqueduct's reinforcing steel. In 1990 and 1991, Taywood-Maunsell Engineers provided inspection reports assessing the Aqueduct's condition and detailing new analysis of the processes causing deterioration of the steel reinforcement within the structure.

Reviewing the situation in 1990, the engineers noted that the Water Board 'has been repairing the worst areas of cracking and spalling for many years, but the extent of the problem has been steadily growing.' While it had always been assumed that superficial repairs undertaken on the structure would serve to stop corrosion of the underlying steel, this could only be guaranteed in fact where the original concrete had been removed from the core section behind the bars, not only in the depth of cover above them. A recent failure condition identified in the bottom chord of Truss no.14 was just the tip of the iceberg, 'indicative of the type of damage which can be expected to become more prevalent in the next 5-10 years,' and requiring immediate repairs 'to avoid sudden collapse of the aqueduct.' [27]

Given what was known of the condition and performance of the structure, Taywood-Maunsell advised that 'Even most of the repaired sections of the trusses are continuing to corrode, albeit slowly, because the carbonated concrete has not been removed… It is likely that every existing original member will need to be repaired within 25 years.'[28] While the Trust and Water Board had received value for money in works that had until then kept the Aqueduct operational, 'such an approach is likely to result in a stage being reached where structural integrity can only be ensured by substantially increasing the scope of the repair works.'[29] To keep the Aqueduct in service for just three years while the replacement siphon was completed would cost an estimated $500,000 ($1.2 million today),[30] while a complete refurbishment programme across the structure was estimated at $5.8 million ($14 million today) initially, with follow-on cycles of expenditures of $2.2 million ($5.3 million today) projected over the ensuing 30 years.[31]

Urgent works to prop Truss no. 14 were undertaken in c. 1991-1992 (Figure 14). This likely averted a partial or complete collapse that would have been triggered by failure of that truss's bottom chords, where deflection and failure of the reinforcing structure remains visible today (Figure 15). Even after installation of the propping, the Contractor at the time was said to have identified the continuing safety risks posed by the failing truss and that further temporary supports and scaffolding would be required to make the truss safe for any subsequent repairs.[32]

A heritage assessment and conservation plan (Allan Willingham, June 1991) was commissioned by the Water Board in response to the heritage nomination. Although Willingham acknowledged the Aqueduct's 'virtually insurmountable design problem that has continued to the present day,' he concluded that 'every effort should be made to guarantee the conservation and preservation of the Aqueduct in an intact condition'[33] and 'only total preservation of the Aqueduct should be contemplated.' Willingham suggested an endowment of the funds the Trust budgeted for demolition, considered that techniques to stop the decay of concrete were being tested overseas, and advocated for responsibility to be transferred to the state government and a committee of management.

In September 1991, the Water Board received legal advice that based on the structural engineer's findings, it must take all reasonable steps to exclude the public from the Aqueduct and its immediate surroundings, including provision of fencing and warning signs.[34] At that time, fences were installed around the terrestrial spans of the structure and warning signs placed at the river channels, although the river itself remained open to water users.

In October 1991, the Aqueduct was included in the Historic Buildings Register.

For the Water Board, the underground siphon's 1992 completion and the Aqueduct's removal from service were important achievements. Decommissioning of the Aqueduct's operational use ended the obligation to accept the increasing repair costs and liabilities required to maintain the sewer's operation and avert a catastrophic diversion of untreated wastewater into local waterways.

1994-1996 activities and enquiries

In 1994 Barwon Water made an initial application to the Historic Buildings Council (HBC) for partial or complete demolition of the Aqueduct to address its ongoing public safety risk. In response, a working group is understood to have been established by the HBC, Barwon Water and others to review potential repair options and sources of funding, including options that would have included partial demolition of some spans. In April 1995 Barwon Water is understood to have withdrawn its permit application to allow these investigations to progress.[35]

Later in 1995 Barwon Water received a further series of analyses and advice by engineers at Maunsell Pty Ltd. Updating previous modelling and projections, Maunsell advised that:

- (August 1995) the Aqueduct 'would have no current margin of safety,' given its advanced state of corrosion and design faults identified in the vertical web truss members, and that 'failure and collapse caused by the failure of compression members often occurs with little warning'[36]

- (October 1995) 'uncertainty regarding the current condition of the Aqueduct, and the rate at which it is deteriorating, make it impossible to predict the rate at which [a] proven factor of safety would be eroded… we consider it prudent for the Board to assume that collapse… could occur at any time.'[37]

The organisation received updated legal advice that Maunsells' opinion 'requires the Authority to prevent all access beneath the aqueduct… the erection of signs advising the risk of falling material or the creation of a mooring, fishing, swimming exclusion zone is [not] sufficient.' Barwon Water was advised that the river should be closed pending a decision to either demolish or attempt to prop the structure;[38] acting swiftly, it determined that day to close the river.

In December 1995 the Minister for Planning formed a Panel of Inquiry to investigate the Aqueduct's prospects for physical conservation, their financial implications, the extent to which it could be safely maintained and managed, roles for the community and the area's recreation and tourism potential. The 1996 Panel Report echoed the 1991 assessment in suggesting a staged approach to repair would 'leave the way open for the development of other repair methodologies' and 'facilitate funding of repairs being drawn from a wide group in the community.'[39] The first repair stage was to be funded by government, with 'direct public contributions' solicited for later stages 'once greater public awareness of the existence and significance of the structure has developed.'[40] There was hope that the Aqueduct could be returned to use as a pedestrian bridge.

Ownership was recommended to be transferred to a Crown Reserve under a committee of management of several public agencies; Barwon Water indicated that it was willing to make the transfer, however neither the ownership transfer nor the Panel's recommended funding model were adopted by the Victorian government. The Panel's expectation of more effective and economical concrete repair methodologies similarly did not transpire—in the subsequent 20 years no technical or management innovation has arisen which served to substantively improve the feasibility of rehabilitating and maintaining the Aqueduct.

Post-2000s studies and investigations

From 2007-2009, the Heritage Council of Victoria funded trials by Australian Corrosion Consultants (ACC) to confirm whether ongoing deterioration of the Aqueduct's reinforcing steel could be arrested with chemical realkalisation or cathodic protection. In 2009, GHD was separately commissioned by Barwon Water and Parks Victoria to prepare an initial feasibility study of management and restoration options to enable development of the Barwon River Parklands.

The two studies produced somewhat contradictory findings, albeit with similar scales of cost. ACC proved that the new technologies could be used on the Aqueduct, estimating the cost of repairing less than 19% of the concrete cover and installing a cathodic protection system at $13.3 million ($20 million in today's dollars) and assumed that little further concrete repair would be required following this initial programme. Challenges with working over the river were unresolved, and no requirement was identified to establish safe work controls for the risk of structural collapse during the conceptual repairs and installation of the cathodic protection systems. In contrast, GHD heeded Maunsell's earlier advice that 100% replacement of the existing concrete cover would ultimately be required, at a comparatively higher cost of upwards of $50 million ($75 million today). Importantly, although GHD's feasibility analysis did not recommend that repair programme for reasons of cost, it also had not factored the feasibility of controls for worker safety during the works.

In comments reviewing the 2009 GHD report, Heritage Victoria's then-Executive Director (ED) questioned GHD's recommendation to undertake partial demolition of the Aqueduct's river spans, pointing to ACC's cost estimates. The ED recommended Barwon Water self-fund repair and maintenance works, following which 'the transfer of ownership from Barwon Water… would become a more feasible option.'[41]

Three subsequent feasibility studies were commissioned from Ken Macleod (2016), GHD (2017) and Lovell Chen and Arup (2019). Each study reviewed sets of management options to rehabilitate, stabilise or make safe crossing areas below the structure and identified preliminary cost estimates. Although each report was distinguished in the specific options assessed and in the objectives of their structural design concepts, none identified new techniques or

substantially reduced costs that could demonstrate repairs could be achieved and sustained in the long term within a feasible scale of expenditure. The 2025 Structex Engineering Peer Review (refer Annexure B) identifies that none of the recent studies directly evaluated the *constructability* of their assessed options. Although the Lovell Chen and Arup study did identify permanent propping as a likely precondition for any future repair given the structure's condition, a detailed understanding of the collapse modes and potential consequences for safe construction had yet to be developed.

Following the 2019 study, Barwon Water resolved to proceed with an application for demolition of the river spanning trusses; this application led to the 2020 heritage permit (P32806) which approved demolition of four spans conditional on structural propping and other works to prevent collapse of the 10 spans which were planned to be retained. After a four-year period of intensive planning, design development, contractor engagement and constructability reviews, including satisfaction of the heritage permit's pre-start conditions, Barwon Water determined that the works required to implement the heritage permit could not be undertaken safely.

Summary comment

There appears to have been no specific point prior to 1992 in which a single investment or works programme would have averted the Aqueduct' ongoing deterioration (Figure 16).

As early as 1924, less than a decade after construction, the issues with the physical and chemical failure of covering concrete and corrosion of the underlying steel had been identified. Advising the Trust on these issues, the Aqueduct's own design engineer manifestly did not believe existing faults (although severe) would eventually progress to the larger truss members, and specifically advised against replacement and thickening of the concrete cover on those members to depths that other engineers in the 1920s already considered to be the correct standard for reinforced concrete structures.

The Trust (to 1984) and Water Board (from 1984 to 1994) repeatedly invested in the Aqueduct over its 75-year operational life, repairing visibly failing concrete members in order to maintain the continuous operation of the Aqueduct while it was essential infrastructure. In these works, the Trust acted in a manner consistent with the advice it had received from Stone and other engineers in the 1920s, that reinstatement of failing concrete cover would prevent further decay of the reinforcing steel. Works in c. 1957-1960 responded to developing failures that were understood to have placed the structure at risk of collapse 'within the next ten years'; it was hoped the repairs would extend the structure's life 'at least a further 25 years.'[42] Despite those works, a new engineer in 1974 found the Aqueduct's condition 'disturbing' and a cause for urgent interventions, which were also undertaken.

By the 1980s improved technical understandings of concrete decay and a visible acceleration of material degradation throughout the structure were reflected in updated engineering advice received by the Trust and its Water Board successor. Perhaps for the first time, it was understood by consulting engineers and public managers alike that the process of corrosion and eventual failure of the Aqueduct's reinforcing steel was in train, even in parts of the structure with apparently intact concrete cover. Addressing this latent chemical process throughout the structure entailed a scale of costs determined in the mid-1980s to be unreasonable to absorb on an ongoing basis.

Once ongoing repair and operation could no longer be guaranteed or considered fiscally responsible, the Water Board acted to plan and construct the Aqueduct's replacement while continuing to undertake urgent works to prevent loss of the structure while it remained operational. The Board explored the costs and feasibility of continuing to repair the structure after its decommissioning, however this was unviable for a number of reasons. These included the high cost of the repair programme estimated by Taywood-Maunsell in 1990-1991, which would have been spent against a non-operational asset, could not be recapitalised and would be challenging to justify to ratepayers and government oversight.

In 1991 Taywood-Maunsell identified, much as E G Stone had done in response to the Aqueduct's 1923 condition, that accumulating faults placed it at a concerning risk of failure and collapse. Prior to the propping of Truss no. 14

(undertaken shortly after their assessment), they considered it 'likely that a structural failure will occur within 10 years.'[43] The hazards remained following the Water Board's 1994 reorganisation as Barwon Water. Although one truss had been propped, Maunsell Pty Ltd advised that it would be prudent 'to assume that collapse of the Ovoid Sewer Aqueduct could occur at any time;'[44] a risk reiterated in current specialist engineering advice to the owner.

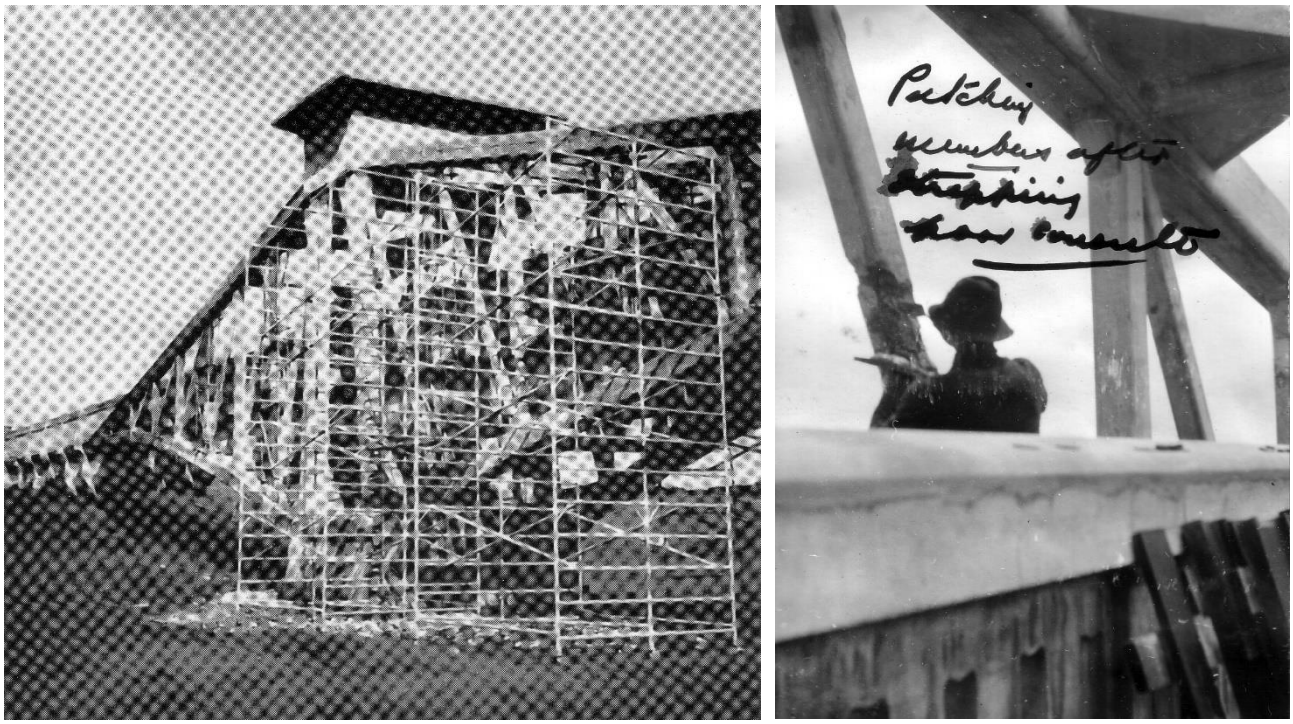

Figure 12 Historical photographs of concrete repair works, possibly those specified by E.G. Stone in 1924
Source: Barwon Water archives

Figure 13 Recasting of a truss cross-brace beam while the structure remained in service, likely c. 1984; freshly repaired or recast sections are also seen just behind it on the truss top chord and vertical member at left
Source: Barwon Water archives

Figure 14 Truss 14 (south end of Aqueduct) with permanent propping installed c. 1991, exposed steel reinforcement, cracks, repaired and recast pier leg and web members, failed patch repairs
Source: Lovell Chen archives (photographed 2019)

Figure 15 Detail of propped Bottom Chord on Truss 14 with exposed and buckled steel rods, apparent deflections and extensive concrete spalls accumulated on top of the c. 1991 steel props
Source: Lovell Chen archives (photographed 2021)

Figure 16 Example deterioration of the concrete cover and underlying steel reinforcement across the Aqueduct
Source: Glasshouse Creative Media (2022), courtesy Barwon Water

3.0 Heritage permit P32806 (2020)

In November 2019 Barwon Water applied for the partial demolition of the Ovoid Sewer Aqueduct in order to open access within the river channels as well as on the adjoining banks.

The application was the subject of an extended period of public advertising in May and June 2020, in which more than 20 public submissions were received, reflecting a variety of positions in respect to the proposed demolition of the four river spans. While a number of detailed submissions were made in opposition to the proposal, other submissions wrote in favour of the works required to open the river channels and allow for restoration of ecological values and Wadawurrung cultural practices within the floodplain.

After further engagement between Heritage Victoria and Barwon Water on the feasibility of undertaking stabilisation works prior to the proposed partial demolition, the P32806 heritage permit was issued in November 2020.

3.1 Scope of approved works

The current heritage permit allows

> Demolition of four (4) of the fourteen (14) pier and truss spans, and retention of the four (4) associated pier base structures, removal of the existing exclusion fencing, establishment of an expanded public exclusion zone and new fencing and delivery of a heritage interpretation program.[45]

The permit includes conditions requiring the delivery of a 'Conservation Works Package' which the permit described as:

> works that will reasonably avoid the catastrophic collapse of the Aqueduct structure, taking into consideration the flood prone nature of the site, the forthcoming demolition works, and to secure the long-term future of the structure.[46]

This permit condition was intended to achieve the installation of structural propping to stabilise the structure's 13 unpropped spans, along with any other works to meet the requirement of 'reasonably avoiding a catastrophic collapse.' In combination, the approved partial demolition works and required conservation works (i.e. permanent propping, Figure 17) constituted the permitted scope of works, and are referred to as such below. Other permit conditions required:

- Appointment of a Structural Engineer and Heritage Consultant to advise the owner and Heritage Victoria during the course of the permit's approved and conditioned works
- A programme of archival recording, including conventional photography and 3D recording
- Preparation of a Heritage Infrastructure Management Plan for the place's long-term management and inspection, including response procedures for the structure's anticipated modes of failure and collapse
- Preparation of costed documentation at the project's completion for a future restoration programme (recognising that implementation was beyond the scope of the permit and would require identification of external funding)
- Preparation and delivery of a Heritage Interpretation Plan.

The requirement as part of the permitted works to mitigate the collapse risk and identify a viable regime for long-term management required an improved understanding of the potential modes of failure that would lead to a progressive collapse. This was to ensure the propping design substantively mitigated the progression of a failure to a full collapse, as well as to understand and manage residual risks that would remain at the site after propping. Once these factors were explored in detail, however, there were important ramifications for the project team and Barwon Water's understanding of the challenge of safe construction around the Aqueduct structure, as explained below.

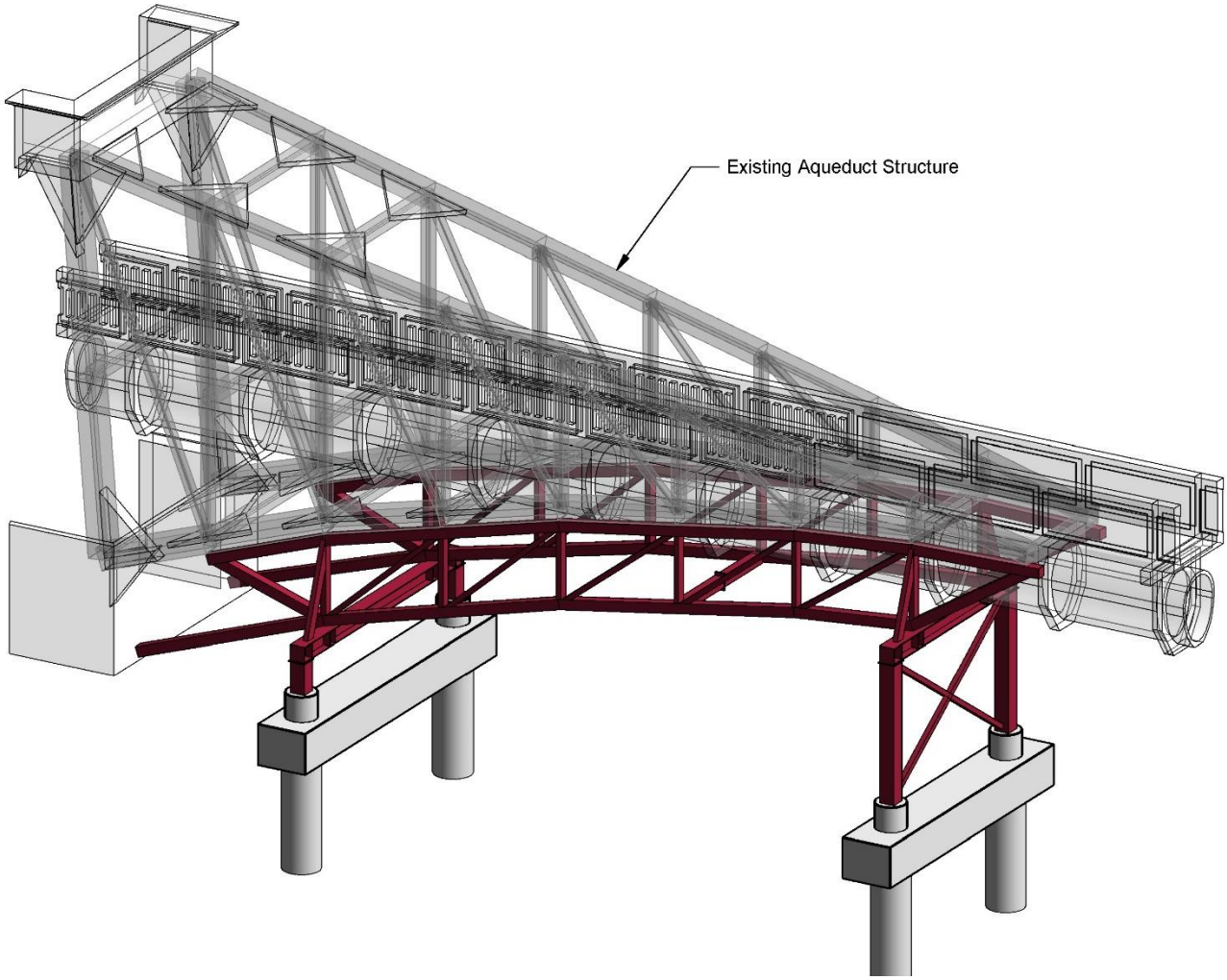

Figure 17 Arup-designed permanent propping as tendered, 2021
Source: Courtesy Barwon Water

3.2 Summary of permit implementation (2021-2024)

A summary of permit implementation activities and design investigations is provided below. As the project team worked to meet the project's complex pre-commencement conditions and constructability challenges, Barwon Water sought and was granted several administrative permit amendments, including extensions to conditional timeframes and expiries, and a variation to the permit's required staging of project works.

Period	Summary of implementation activities
December 2020 to June 2021	Following receipt of the permit, Barwon Water moved quickly to begin implementation activities. Arup and Lovell Chen were appointed as Structural Engineer and Heritage Consultant under the heritage permit conditions, and initial documentation was prepared for tender. In parallel, Barwon Water secured planning approvals and environmental consents, as well as developing a *voluntary* Cultural Heritage Management Plan (CHMP) for the extensive site establishment works (outside the VHR registered area) which are required to enable the project.
July 2021 to August 2022	In July 2021, Barwon Water appointed the project's first contractor, McMahon Services, with its design engineer Wallbridge Gilbert Aztec (WGA). Over the next year detailed construction documentation and methodologies were developed by McMahon and WGA during an Early Contractor Involvement (ECI) and early works stage, and these were endorsed by Heritage Victoria in August 2022. During this period, Lovell Chen and Arup also prepared the required long-term management plan (HIMP), which Heritage Victoria also endorsed in August 2022. Barwon Water subsequently re-tendered the project on the basis of the endorsed WGA propping design; Simpson Construction Co. was appointed in May 2023 as the project's second Contractor.
May 2023 to July 2024	From May to July 2023, Barwon Water conducted a detailed safety review of the WGA design with its second Contractor and consulting engineers (WGA and Arup), ultimately concluding the design could not be safely constructed due to the required placement of workers beneath and within the structure. This was no longer considered safe due to collapse modes and exclusion areas identified in the HIMP. In August 2023, Arup was appointed to develop a modified propping scheme that could satisfy safe work requirements around the hazardous structure, working closely with the second Contractor as well as risk specialists within Arup and at Barwon Water. This work continued through several design revisions during the first half of 2024 (examples at Figure 18 and Figure 19).
August 2024 to November 2024	In August 2024, Barwon Water concluded its risk review of the permitted structural propping, determining that the permitted project (including propping) would generate potential health and safety risks above and beyond those typically associated with construction and demolition activities. Following this, further alternatives were reviewed over several months, including modified schemes for end propping to facilitate only the river span demolition (similar to the project as originally proposed in the 2020 application) and examination of whether a greater scope of demolition (with retention of just one or a handful of trusses) could be undertaken safely.
December 2024 (decision)	In December 2024, based on expert assessments produced internally and within an independent risk review team at Arup, Barwon Water determined that no scenario which required installation of conventional propping could be safely constructed. The organisation also determined that the risks of retaining an unpropped structure after partial demolition of the unpropped river spans were no longer acceptable given its duties of care. Based upon these determinations, Barwon Water no longer considered it feasible or advisable to implement even an amended version of the P32806-permitted project. These considerations are discussed in detail in the Barwon Water Position Statement which accompanies the application, and are referenced in the s.101(2)(d) assessment (Section 5.3)

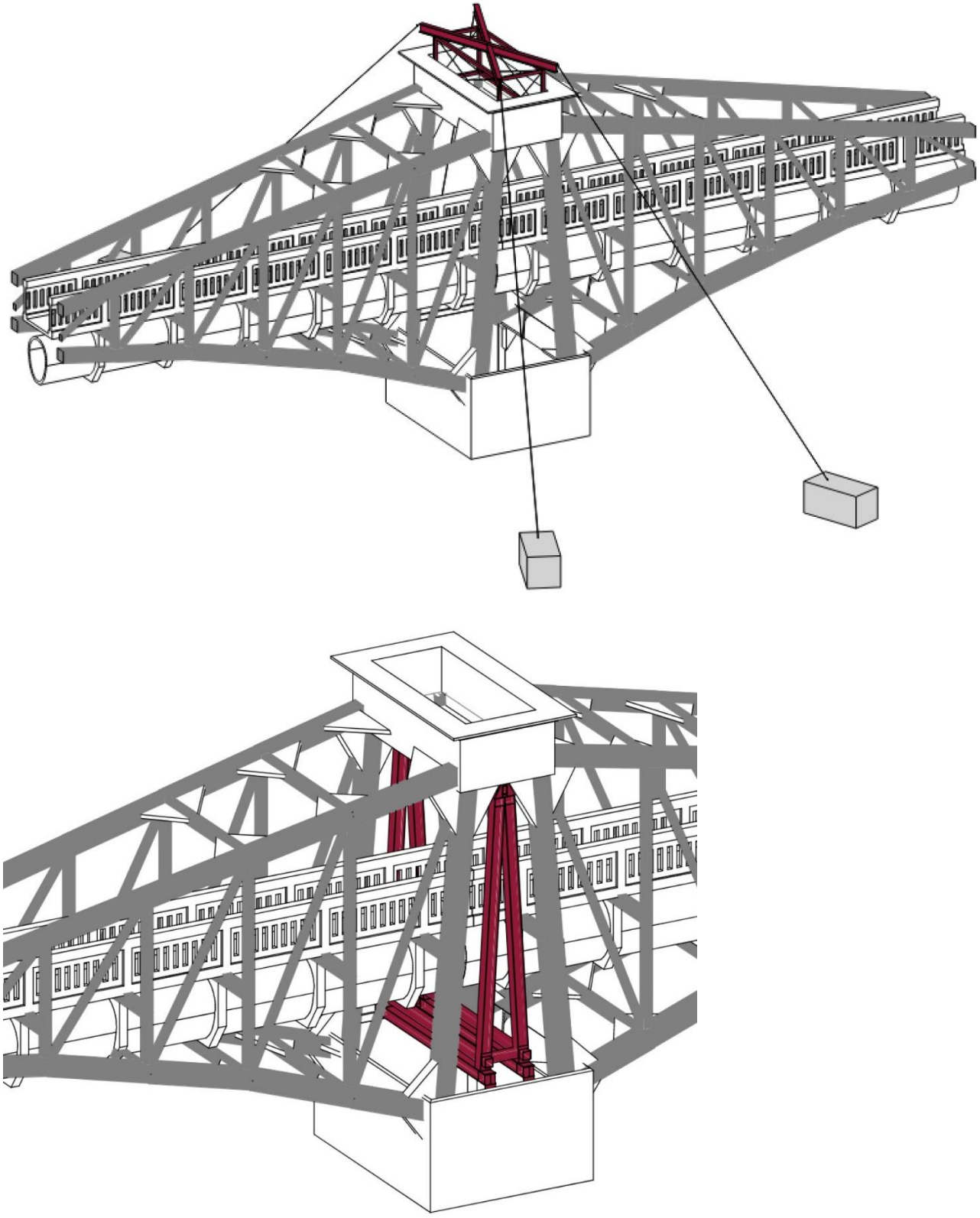

Figure 18 Examples of additional temporary and permanent works (Arup, 2024) designed to address the structure's collapse risk during and after the 2020 permitted project
Source: Courtesy Barwon Water

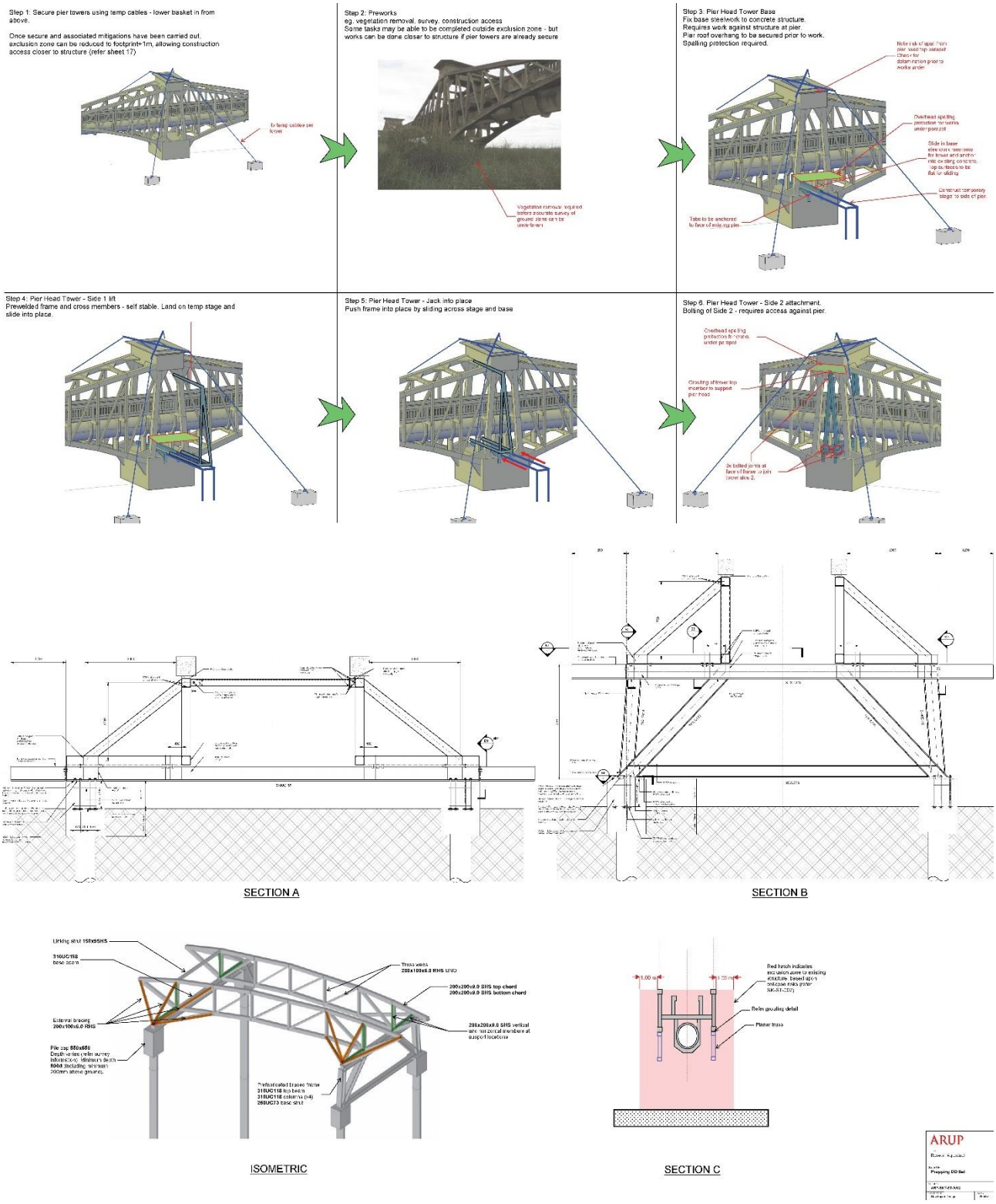

Figure 19 Examples (Arup 2024) of detailed efforts to resolve propping details and construction methodologies that would enable remote handling and safe completion of the 2020 permitted project's propping works
Source: Courtesy Barwon Water

Heritage Infrastructure Management Plan (HIMP)

The Part 1 HIMP was a pre-commencement requirement of the 2020 heritage permit (conditions 13 and 14). Prepared by Lovell Chen and Arup and endorsed by Heritage Victoria in August 2022, the HIMP was directed at achieving the defined objective of *reasonably preventing* the Aqueduct's collapse and catastrophic loss.

The 2020 heritage permit envisioned ongoing active management at the Aqueduct after completion of the permitted project. The permit sought to permanently mitigate the Aqueduct's risk of collapse using propping, ongoing structural inspections and monitoring, and defined procedures for responding to a detected structural failure or emergency.

To provide a basis to understand what such a regime would require, Arup developed a detailed analysis of the modes of collapse that could affect the Aqueduct as it decayed, and assessed the extent to which each type of failure and collapse was mitigated by the permitted structural propping or could be addressed through other measures. On this basis, the HIMP described the long-term management approach that would be implemented after the permitted works were completed, including emergency preparedness and response procedures, maintenance and inspection schedules, and protocols that would be initiated after any of 10 distinctive failure patterns were identified.

The HIMP documented these procedures in line with the permit requirements, in order to provide an ongoing and active management regime that could assure—as a minimum—the safe and controlled retention of the structure over a long period of time. Such an active management regime, reliant on permanent structural propping, would have been consistent with how other managed ruins have been retained in Victoria on an ongoing basis, including the Former Ovens District Hospital (VHR H0358), Walkerville Lime Kilns (VHR H2043), Garfield Waterwheel Quartz Goldmining Site (VHR H1356) and the so-called 'Forest of Piles' in the waters off the redeveloped Princes Pier (VHR H0981). All of these are reliant on some form of active management regime and ongoing hazards mitigation.

The HIMP's detailed assessment of failure modes within the structure and of required exclusion zones for vulnerable personnel subsequently informed design development to implement the permitted project, including the safe work methodologies and detailed risk assessments that have sought to assure the permitted works could be safely undertaken

The findings of those subsequent assessments (as outlined below) have demonstrated that a number of elements of the HIMP's proposed management regime would not have proven feasible to undertake or to maintain in the long-term. In particular:

- Ongoing risks from spalled concrete and local failure of upper truss members would always apply close to the structure, meaning simple activities such as vegetation management could not occur safely over the long-term.
- Once installed, safe access to propping structures for repainting and refurbishment was unlikely to be practical, especially following years or decades of ongoing deterioration in the overlying concrete trusses; new propping structures would not be maintainable and would eventually deteriorate and form part of the unmanaged ruin.
- Even after propping, little to no safe option existed to physically respond to a developing structural failure detected during regular inspections and monitoring. The outcome of a failure in the upper chords, pier towers or walkways could only be partly mitigated by the propping and would not be safely addressed following an occurrence, leaving residual risks of localised collapse involving components of one or more trusses. Although HIMP procedures identified steps for provision of engineering advice and designed responses to a developing failure, in practical terms the only available options would be to reimpose larger exclusion areas and/or to pursue demolition (if, for instance a partly collapsed section of the propped structure remained unstable).
- No practical methods exist to fully secure and prevent unauthorised public access to the Aqueduct and exclusion zone. Given the structure's known hazard conditions, a potential liability would continue to exist for personal injuries sustained by trespassers from spalled concrete or a collapse.

Arup engineering design report and risk assessments

The studies and assessments undertaken on the Aqueduct over the past five years have yielded a substantial body of knowledge regarding technical aspects of the existing structure, including its current condition, structural behaviour and potential failure modes. This has in turn informed significant safety limitations regarding any works in the vicinity of the structure, which have formed a brief for design of interventions to the structure.

Based on this body of work, Arup has prepared a summary design report (Engineering report, Annexure A) which describes and analyses the design of the Aqueduct, its structural behaviour and its condition and provides an overview of the various options for stabilised retention (including propping, restoration and reduction of load).

Section 4 of the report describes the structural behaviour of the Aqueduct based on its design (balanced cantilever) and including the attendant risks of span failure, the interconnected nature of the design and the potential for progressive or 'catastrophic' collapse. The report goes on to describe the risks associated with different failure modes, and the challenges (hazards) these failure modes present for implementing works around the Aqueduct.

While there are a range of failure modes that could occur, from a safety risk perspective, Arup has grouped these into three sets:

1. Sideways collapse - structural failure (or failures) leading to concrete debris falling outside the Aqueduct footprint
2. Vertical collapse – structural failure (or failures) leading to concrete debris falling within the Aqueduct footprint
3. Spalling failures – localised chunks of concrete detaching from the structure

Section 5 describes the condition of the structure and the mechanisms for deterioration. It concludes that the structure is in poor condition, is degrading over time and future collapse (with significant safety risk) is inevitable (though without a means of accurately predicting when or how that will occur).

Section 6 describes the various structural engineering interventions that were contemplated (propping, load reduction and other actions) to achieve a state of stabilised retention in the process of developing the partial demolition proposal that was ultimately put forward and approved in the 2020 permit.

Section 6.2-6.4 of the report picks up the structural design and risk assessment and mitigation work that was undertaken post the 2020 permit. This work focussed on the subsequently describes the structural design work undertaken to deliver the scope of works under Permit P32806, in particular the propping designs, as well the work to incorporate design mitigations to eliminate or reduce risks to construction safety.

Once the final design and mitigations has been developed and tested they were taken through a formal risk assessment process aligned with both WorkSafe Victoria guidelines and Section 20(2) of the *Occupational Health and Safety Ac*t (OHSA) to assess the residual risks. Refer to Section 7 of the report.

While some risks were reduced with the implementation of potential controls, there remained significant residual risks:

- Risks associated with spalling were reduced to insignificant to medium
- Risks associated with vertical collapse remained between medium and high, largely due to the severe potential outcomes, despite low likelihood
- Risks from horizontal collapse were reduced to medium.

A further alternative scenario was investigated (refer to Section 8) for modular end propping which was a less substantial intervention at piers 8 and 13. The purpose was purely to counteract imbalances generated in the structure at demolition and avoid a demolition-induced collapse during decoupling.

This scenario mitigated many of the residual construction safety risks, however it did not address long term stability or catastrophic collapse of the structure, due to the more limited interaction between the props and the existing structure (i.e. only at the truss tips), and the fact that there was no tower propping. In addition, some aspects of the methodology were considered to have a relatively high likelihood for technical failure and little redundancy in that scenario. Specifically, there was a challenge posed by potential gaps between the prop structure and the existing concrete truss chord causing poor behaviour of the existing structure. A remote system of grouting the gaps using grout bags was proposed, however this was considered to have the potential for technical failure with little redundancy without personnel entering the risk area.

Note that even if propping could be successfully installed, there would be residual safety risk to the public and to Barwon Water employees entering the proposed fenced area (whether authorised or unauthorised access).

For completeness, at Section 9, the Arup report comments on the 'Do Nothing approach':

> … a 'do nothing' approach represents a significant risk to public safety and does not allow for the Barwon Water and surrounding area to be safely reopened to the public.[47]

The conclusion of the Arup investigations was as follows:

> This report provides a summary of the extensive studies and assessments undertaken on the Barwon Sewer Aqueduct over the past five years.
>
> Technical aspects of the existing structure, including its current condition, structural behaviour and potential failure modes have informed significant safety limitations regarding any works in the vicinity of the structure. These have underpinned propping design attempts to meet the criteria of heritage permit P32806.
>
> A full range of possible intervention categories were considered during design and assessment, many of which were deemed unfeasible at the start of the assessment period, due to the poor condition of the structure (concrete repair, cathodic protection, river span propping, do nothing).
>
> Structural propping of the land spans was developed as the most promising intervention, however after significant design work and iterations to eliminate and mitigate safety risks, the most viable design options still resulted in the exposure of construction workers to residual safety risks above the SFAIRP [So Far As Is Reasonably Practicable] threshold.
>
> The conclusion was reached that the stated goals of heritage permit P32806 (partial demolition and conservation of the remaining structure) could not be safely or practically met whilst upholding duty of care responsibilities under OSHA …
>
> Thus demolition of the entire aqueduct superstructure is now put forward as the sole remaining option available. Retention of pier bases and stairs, and potential salvage of other components offer some limited opportunity to retain part of the aqueduct fabric.

StructexAu peer review report findings

The Engineering Peer Review (StructexAu, 2025, Annexure B) was prepared by the experienced structural engineer Phil Gardiner. The review considered each major design option for propping and other protective structures which has been produced for the Aqueduct since 2016 and provides an independent assessment of the design effectiveness and constructability of structures designed by Ken McLeod, GHD, Arup, WGA and Simpson Construction to mitigate the Aqueduct's hazards (concrete spalling and collapse risk).

The Structex report notes that none of the designs were capable of satisfactorily controlling risk of injury during construction, noting that many of the designs that preceded Arup's final 2024 propping scheme required extensive works beneath and within the structure during installation.

The report also questions the ultimate value of the propping stabilisation objective, given that the structure would continue to deteriorate around the propping even if some of the collapse risk had been mitigated and that the propping would be unlikely to be maintainable once installed. The report observes in reference to all the propping options, 'ongoing deterioration of the existing concrete structures and eventual collapse is accepted as inevitable and unsolvable.'[48]

In respect to an alternative 'do nothing' approach that would allow the Aqueduct to continue to decay in an unmanaged condition within an exclusion zone, the report notes that:

> this option presents ongoing risks to public safety that will need to be mitigated by secure fencing to prevent access from both the land and the river, as well as monitoring, noting that the area is remote, in a flood plain subject to inundation and that fencing will require significant maintenance for many years.
>
> There is also the risk that the area becomes unsecured during and after a flood event or that "trespassers" could scale the fences without much difficulty to access the structure.
>
> The only advantage of this approach is that a piece of significant engineering heritage remains somewhat intact for a longer but indeterminate period before eventual collapse.[49]

The peer review report concluded that:

> The time for preservation to be viable has passed and attempts to prop the structure come with considerable construction risk, at likely significant cost and with no guarantee of the structure continuing to stand for any reasonable time, to justify the expense. This also needs to be balanced against the restrictions on access to the flood plain due to safety concerns and other impacts on the environment, natural and cultural heritage. I also note that demolition incurs a significant cost and some risk, albeit a lower safety risk than propping for partial retention in both the short and long terms.[50]

Conclusion

In summary, despite the work undertaken in 2021-2024, there was ultimately only a limited and incomplete ability to assure the controlled, safe and purposeful management of a propped Aqueduct structure as envisioned by the 2020 heritage permit and planned for in the 2022 HIMP. The HIMP's long-term management regime for a propped but unrepaired structure would not halt the future decay of the structure and could not satisfactorily avert the possibility of personal injury at the site. Moreover, as reviewed above and in attachments to the application, the propping system required to create the initial pre-conditions for management cannot be safely constructed.

It is not acceptable to Barwon Water nor consistent with its statutory obligations to indefinitely sustain the possibility of public injury at the Aqueduct.

Consequently, there is no longer a future prospect for active management of the heritage place and for any further actions intended to secure its long-term conservation as had been anticipated by the 2020 permit.

3.3 Alternatives to permit implementation: approaches to heritage ruins

As reviewed in preceding sections, options and proposals for conservation and management of the Aqueduct have been investigated over more than three decades and through recent permit implementation efforts. At its 1992 decommissioning and continuing since, the condition and context of the Aqueduct has fit the common understanding of a 'ruin'.

Best practice approaches for heritage ruins

Ruins: A guide to conservation and management (Australian Heritage Council (AHC), 2013) documents best practice for heritage ruins. It includes a descending series of five management scenarios which respond to the opportunities and physical and environmental conditions of ruined structures. These involve different levels of intervention or active management:

- Coming alive again
- Returning it to its former state
- Simply maintain
- Letting nature take its course
- When removal is inevitable.

Essentially, these move through restoration projects that allow the structure to be reused or at least brought back to good repair, to works to stop decay or simply stabilise a decaying structure and its limit potential total collapse and loss and finally, to works intentionally undertaken when loss or removal of a structure is understood to have become inevitable.

Importantly, the AHC document takes the long view when loss of the ruined place becomes inevitable, noting cultural heritage significance is defined in the Australia ICOMOS Burra Charter as 'aesthetic, historic, scientific, social or spiritual value for past, present or future generations'.[51]

The AHC's *Ruins* guide identifies circumstances that make intentional demolition or removal appropriate, including:

- 'When the complete loss of the place is inevitable because letting nature take its course presents too many hazards'
- 'When the place is creating an unacceptable risk to public safety or an environmental hazard'
- 'Where pressure for alternative use of the site is deemed to outweigh the heritage significance of the place.'[52]

Application of these considerations to the Aqueduct

Past recommendations (such as the 1991 and 1996 assessments) assumed that the Aqueduct could be safely repaired, maintained and even returned to some form of public use; this was seen to justify delaying demolition despite known hazard conditions present in the 1990s. Recent investigations have determined that there is no longer a reasonable prospect for safe stabilisation, repair or other managed retention of the Aqueduct on a permanent basis. Consistent with the AHC's 'When removal is inevitable' scenario, loss and removal of the Aqueduct is now understood to be inevitable; this context necessarily shapes any further action or decision addressed to the place and its heritage significance.

The AHC's guidance notes that 'Loss of a heritage ruin may be preferred over other alternatives with greater heritage impacts' and that in these cases, 'proactive recording prior to removal will enable the place and its heritage values to be understood.'[53] Give the Aqueduct's risk of collapse, the AHC guidance suggests that it is purposeful to consider if intentional demolition and actions undertaken in conjunction with it can mitigate some of the heritage impact of a future uncontrolled collapse. Considering the specific values of the Aqueduct as a heritage place, the accompanying

actions could include not only recording but also permanent interpretation or cultural expressions of its heritage significance and other responses to its values, including those of the objects integral included with the registration.

3.4 Barwon Water decision

A Position Statement from Barwon Water (Annexure C) accompanies the application and explains the organisation's considerations and reasoning in determining to discontinue work to implement the existing heritage permit and to proceed with a proposal to undertake a full demolition of the Aqueduct's spans and towers.

4.0 What is now proposed?

4.1 Demolition

The entirety of the 14 cantilevered truss spans of the Aqueduct would be demolished along with the connecting girder sections they support, including the concrete trusses, pier towers, walkway and suspended ovoid sewer pipe.

A series of ground level 'footprint elements' would be retained, conserved and activated through the proposed Heritage Interpretation Strategy (Section 4.2). These footprint elements (Figure 20 and Figure 21) consist of:

- Stair landings at either end of the Aqueduct, including concrete steps, landing platform and wing balustrades
- Pier bases located below each of the 14 truss spans.

The approach to each of the proposed elements to be retained is briefly described below.

Stair landings

The stair landings stand at the points at which the Geelong Outfall Sewer exited the ground (north end) and re-entered the ground (south end) on its route from the central city to the original ocean outfall at Black Rock (now Barwon Water's Black Rock Water Reclamation Plant). Measures would be taken to isolate and retain the landings during demolition, following which the concrete features would be repaired on both landings.

The North Landing would be integrated into site-based heritage interpretation to be installed at the place within the life of the permit, while the South Landing would be secured and maintained for future activation as part of a public open space identified in the Armstrong Creek North East Industrial Precinct Structure Plan (PSP).

Pier bases

The pier bases cap the central footings for each of the fourteen cantilevered web trusses. The bases are of concrete walled construction with a lower quality fill material, and are embedded in the ground of the floodplain. Except where the bedrock is particularly shallow, each base is fixed on a raft foundation to sets of driven concrete piles. It is anticipated that the pier bases will generally survive the primary demolition works and can be retained as markers.

Following demolition of truss superstructures, any remaining exposed elements of the former pier leg and truss chord anchorages would be removed and pier base walls cut down to a height no more than one metre above ground level (for safety purposes). A new poured concrete slab would be installed across the top of each base structure, and the concrete side walls would be remediated; this remediation is expected to include installation of new concrete cover to all four sides and any other measures required to prevent renewed concrete spalling and decay within the bases.

The remediated pier bases would be employed and activated in delivery of the Heritage Interpretation Strategy.

Demolition methodology

The demolition methodology will be developed by the Contractor and will be subject to review by Arup.

While the detail has not been confirmed, it is anticipated to be carried out using conventional long-reach excavators or similar equipment able to operate from beyond exclusion areas identified by Arup, which are required by the

hazardous condition of the existing structure. Floating barges and temporary bridges would be employed within the two river channels. The methodology would be subject to contracting arrangements and statutory codes and requirements, and would be confirmed under the conditions of the heritage permit (if granted).

All demolition debris would be removed from the site and the river environment and safely disposed, except where opportunities for artefactual salvage and display of expressive elements of the structure are identified after the primary superstructures have been brought to ground. The Heritage Interpretation Strategy details the rationale and approach to proposed opportunistic salvage of segments of ovoid pipe, original concrete and reinforcing steel (where it is safe to do so).

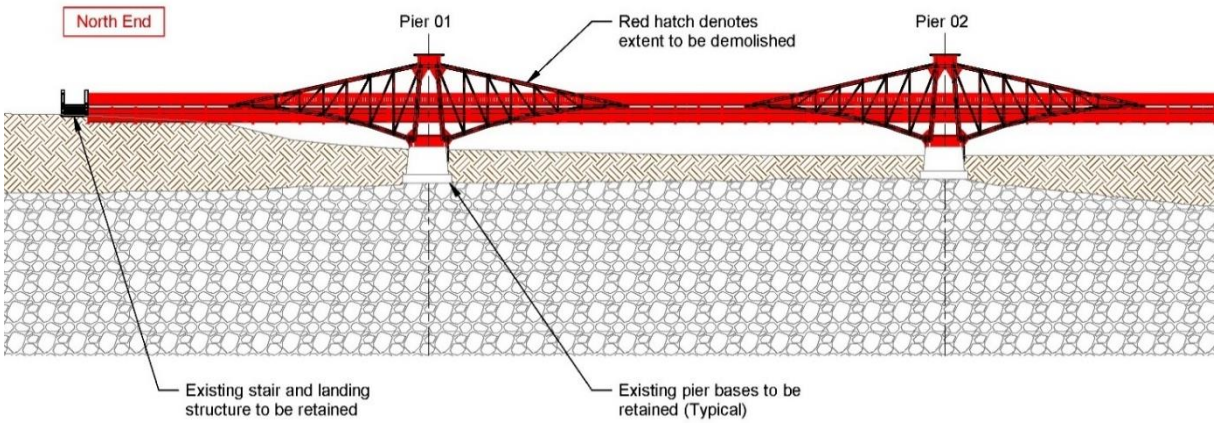

Figure 20 Detail of Long Section at Piers 01 and Pier 02, showing proposed demolition of Aqueduct superstructures with retention of footprint elements (North Stair Landing and Pier Bases)
Source: Arup, Barwon River Ovoid Sewer Aqueduct, Overall Plan and Section, 1703-S-1001

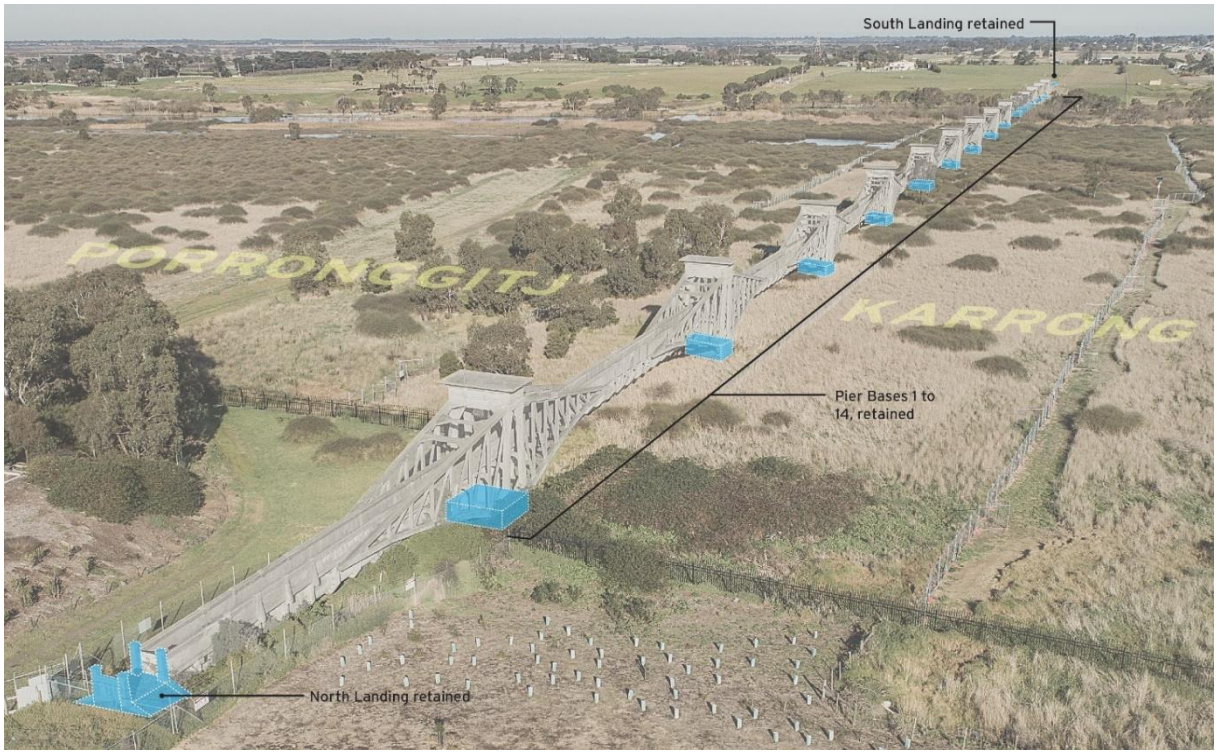

Figure 21 Illustration identifying the proposed retained elements of the structure after demolition
Source: Aqueduct Heritage Interpretation Strategy (Lovell Chen, August 2025)

4.2 Heritage Interpretation Strategy

The Heritage Interpretation Strategy has been developed to ensure that the heritage place will continue to convey and represent key aspects of the Aqueduct's heritage significance, while generating opportunities to extend the story to other sites and venues where the Aqueduct's history and innovative engineering can also be celebrated.

The strategy includes the proposed development and delivery (within the life of the heritage permit) of:

- **Site-based interpretation** (North Landing site, terrestrial and river channel pier bases, track infrastructure)
- **Off-site interpretation**, consisting of permanent interpretation features and educational exhibits
- **Online exhibits** and other digital and physical **interpretive and archival media and recordings**
- **Temporary events and activities** to commemorate the Aqueduct prior to demolition.

It is proposed that a detailed Heritage Interpretation Plan (HIP) would be prepared for approval under the conditions of the proposed heritage permit (if granted), following which the site-based interpretation would be documented for the Executive Director's endorsement. Other off-site aspects of the interpretation programme would be confirmed within the HIP, however delivery of these elements would occur outside of the registered heritage place.

The site-based interpretation would generally be installed within the existing registered land area north of the river or associated with the retained structural elements described above. The approach taken would be comprehensive; alongside the retained elements and conventional landmarking and didactic signage, the on-site interpretation system proposes to include new physical features: vertical markers, expressive elements, and public access infrastructure. The details of the system are subject to design, stakeholder engagement and statutory approvals (including planning and CHMP compliance), but are described in overview below and in the Heritage Interpretation Strategy.

North Landing

The North Landing site is proposed to include the retained stair landing and the closest adjacent pier bases (refer **Section 4.1**), as well as new physical structures to be located on or adjoining the pier bases. This has been identified as the key on-site interpretation node where the relationship between the Aqueduct and the Geelong Outfall Sewer can be explored and where views south can be articulated along the Aqueduct's former alignment towards the South Landing site. A conceptual design of the North Landing site's new features and site works would be confirmed through the HIP, and proposed works delivered within the life of the permit.

In overview, the North Landing site is proposed to include the following permanent interpretation elements:

- A **Vertical Marker**, erected on or adjacent to Pier Base 01 and the Stair Landing, consisting of a tower structure which can be seen from a distance and which would integrate expressions of the Aqueduct's aesthetic or technical characteristics. Wadawurrung living cultural values may also be reflected in the design of the Marker, such as a reference to the Brolga
- A **Viewing Platform**, providing views south along the Aqueduct alignment with supporting interpretation
- The retained **North Stair Landing** and **Pier Bases 01 and 02**.

Subject to design, one or more salvaged ovoid pipe segments (where it is safe to do so) may also be integrated into the North Landing site.

Interpretation at the North Landing site would provide an overview of the history, design and technical significance of the Aqueduct, and would reflect upon the site's relationship with the Geelong Sewer System and to Wadawurrung living culture and renewed environmental stewardship of the Barre Warre Yulluk (Barwon River) waterway. Installed interpretation would be designed to be robust and hard-wearing and to incorporate physical and interactive features in preference to didactic signage where possible. Due to the remote nature of the location and conditions in the river environment, didactic detail may largely be delivered through digital means, however some conventional signage is also anticipated to be provided and maintained at the site.

Pier bases

The pier bases would be visible when looking south from the North Landing area and the proposed Viewing Platform, allowing the former length and alignment of the Aqueduct to be understood by visitors. Perspex viewers or other techniques will also be investigated to enhance visitor appreciation of the former scale and form of the Aqueduct.

Large-scale stencilled inscriptions (formwork or sandblasted) are proposed to be added to the new concrete coverings of each pier base, and would be designed to express relevant historical and Wadawurrung living cultural information in a robust form that is resistant to flooding, vandalism and other aspects of the floodplain environment. Due to the nature of the floodplain vegetation, these inscriptions likely would only be visible at close range.

The Interpretation Strategy suggests the historical component of the inscriptions would be a consistent wayfinding mark identifying the Aqueduct, the date of construction, and the pier number (in sequence nos 01 to 14 north to south), this would be inscribed on all 14 Pier Bases, with potential for additional inscriptions expressing the Aqueduct's historical themes on the pier bases at the North Landing site and on the bases flanking the south river channel (to be confirmed in the future HIP). Pier Bases 13 and 14 south of the river would simply have the historical inscription during the permitted works, pending future activation of this area in the longer term.

North of the river within Porronggitj Karrong, the first eight retained pier bases are proposed to be accessible as features along a visitor 'learning trail' that would run along the former alignment of the Aqueduct, from the North Landing to the river. This trail would intersect east-west access tracks anticipated to be retained or developed within Porronggitj Karrong, and would connect with the principal public access route to the North Landing site. The two pier

bases that flank the north river channel (pier bases 09 and 10) may be included within the trail or could receive a specific cultural treatment responding to their position on the river.

All living cultural values inscriptions would be designed in collaboration with WTOAC to reflect Wadawurrung living culture and to express site-specific ideas and knowledge of the river environment; these inscriptions would also extend cultural interpretation integrated within coordinated features and signage at the North Landing site.

South Landing

The Heritage Interpretation Strategy anticipates developing further site-based interpretation at the South Landing area, which has been identified as a future public open space in the Armstrong Creek North East Industrial Precinct PSP. This land is currently in private ownership. Due to the long-term strategic planning and development timeframes for land assembly, servicing and public access to this location, installation of major features at the South Landing is most likely to occur as much as 10-15 years after the completion of the heritage permit.

Barwon Water has indicated a commitment to work with partner agencies and landholders to achieve a similar scale of interpretive response at the South Landing once open space development occurs at that site.

Off-site, online and temporary components

An ambitious programme of potential off-site, online and temporary events components is detailed in the Heritage Interpretation Strategy that forms part of the application. The finalised scope and timeframes for delivery of these components would be confirmed within a future HIP and would be proposed to be the subject of permit conditions.

These elements would not generally have a physical connection to the heritage place, although some may be linked to physical signage or waypoints at the place using digital retrieval technologies so that they can be accessed from a mobile device.

Retention of Pier Bases

Sewer Landings retained at north and south ends of structure

Figure 22 Detail of retained footprint elements for activation in the proposed Heritage Interpretation Strategy
Source: Aqueduct Heritage Interpretation Strategy (Lovell Chen, August 2025)

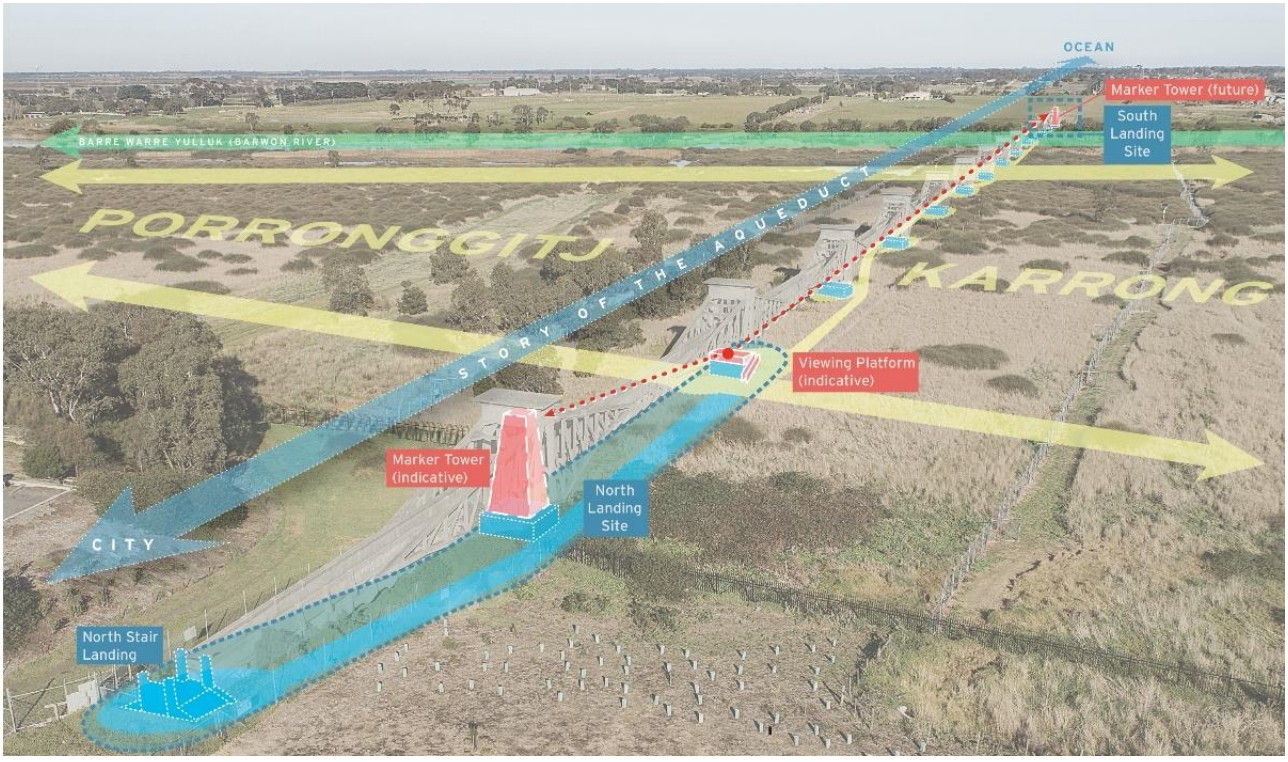

Figure 23 Concept illustration showing the spatial and storytelling relationship between the North Landing site, pier bases and (future) South Landing developments, within the context of the Outfall Sewer and Porronggitj Karrong
Source: Aqueduct Heritage Interpretation Strategy (Lovell Chen, August 2025)

5.0 Matters to be considered under the Heritage Act

Under Section 101 of the Heritage Act 2017 various matters are identified as factors to be considered by the ED in determining whether to approve a permit application; the relevant clauses are reproduced below with sections relevant to this application shown bolded:

(2) … the Executive Director must consider the following—

a) the extent to which the application, if approved, would affect the cultural heritage significance of the registered place or registered object;

b) the extent to which the application, if refused, would affect the reasonable or economic use of the registered place or registered object;

c) any submissions made under section 95 or 100 *[to be considered but not addressed in this HIS];*

d) if the applicant is a public authority, the extent to which the application, if refused, would unreasonably detrimentally affect the ability of the public authority to perform a statutory duty specified in the application

e) if the application relates to a listed place or to a registered place or registered object in a World Heritage Environs Area, the extent to which the application, if approved, would affect—

f) the world heritage values of the listed place; or

g) any relevant Approved World Heritage Strategy Plan;

h) any matters relating to the protection and conservation of the registered place or registered object that the Executive Director considers relevant.

(3) In determining whether to approve an application for a permit, the Executive Director may consider—

a) the extent to which the application, if approved, would affect the cultural heritage significance of any adjacent or neighbouring property that is—

a. included in the Heritage Register; or

b. subject to a heritage requirement or control in the relevant planning scheme; or

b) any other relevant matter.

The identified relevant considerations are each reviewed in turn in the sections that follow.

5.1 Impacts on cultural heritage significance [s. 101(2(a)]

Overview of significance

The VHR statement of significance for the Aqueduct advises that it is of 'historical, architectural, aesthetic and scientific (technical) and aesthetic significance to the State of Victoria', meeting criteria A, D, E and F.

These values are further expanded upon in the statement, under the heading 'Why is it significant?'

> The Ovoid Sewer Aqueduct is of historical significance for its association with the inaugural work of the Geelong sewerage scheme in 1912-15. Geelong was one of the first regional Victorian cities to implement plans for the construction of a sewerage system. [Criterion A]
>
> The Ovoid Sewer Aqueduct is of architectural significance for its association with the engineers Edward Giles Stone and Ernest J Siddeley, who undertook a number of marine projects in southern and eastern Australia, including reinforced concrete ships and pontoons. Stone was a highly innovative and creative engineer whose daring structural systems challenged the limits of construction technology in the early twentieth century. His advanced work in reinforced concrete, the Considere system in particular, is of great importance and his design derivation from the steel Firth of Forth Bridge in Scotland is of particular note [Criterion D].
>
> The Ovoid Sewer Aqueduct is of aesthetic significance as a major landscape feature. Its dramatic setting in the Barwon River floodplain near Breakwater, Geelong is of great importance. [Criterion E]
>
> The Ovoid Sewer Aqueduct is of scientific (technical) significance as an example of pioneering concrete work of structural ingenuity and monumental scale. The early and innovative use of reinforced concrete in the Considere system, which was the most innovative form of reinforcement used in Victoria, is of great significance. The aqueduct remains as a rare example of this type of concrete construction. It is also of scientific (technical) significance for its overall length and the maximum span length, both of which appear to be in excess of that of any other Victorian reinforced concrete structure at the time of construction. [Criterion F]

It is noted that while assessments of the Aqueduct's significance have focused on the structure's innovative construction, its history of material failure, although acknowledged, has generally been treated as a footnote. The complete story of the Aqueduct includes its near-immediate material failure, the unsuitability of the structural design (as compared with the steel truss bridges it had been based upon) as adopted in a concrete structure, and efforts in spite of these challenges to maintain the structure over many decades while it was an essential operational asset.

The Aqueduct structure is significant as an innovative design, but equally in the process of deterioration and material failure, it has demonstrated the limitations and constraints of reinforced concrete as used in such a structural system. The open truss design and its shallow concrete cover proved vulnerable to material deficiencies, unsuited to the damp and saline environment of its site, and impractical to maintain and to reverse progressive deterioration.

Notwithstanding the above comments, the scientific (technical) significance of the Aqueduct can be seen to reside in the ambitious and innovative, if flawed design, in the application of new construction technology, in the history of its construction and in the scale of the outcome, as related to the component parts and the total extent.

The Aqueduct is also of historical and architectural significance for its associations with its designers, engineers Edward Giles Stone and Ernest J Siddeley, and as an example of the Considère system.

It also has important historical associations with the early history and inaugural works by the Geelong Waterworks and Sewerage Trust to establish the Geelong sewerage scheme.

Finally, the Aqueduct is significant for its aesthetic qualities, as a major landscape feature in the Barwon River floodplain, its striking presence a function of its scale, siting and distinctive design.

Impact of demolition on significance

The heritage place would remain but the Aqueduct structure itself would be largely demolished, with the exception of the pier bases and end stairs and landing platforms, where the intention is to retain these as part of the proposed heritage interpretation strategy.

There would be no works or actions that would impact on the registered 'objects integral,' which are located separately at the Marshall Railway Station.

The demolition of the majority of the Aqueduct structure would have an adverse impact on the state-level significance of the place, in particular its scientific (technological), architectural and aesthetic significance, all aspects that derive from the structure's physical fabric, distinctive design and presence in the landscape.

The scientific (technical) significance under Criterion F and architectural significance under Criterion D would be greatly diminished with the removal of the above ground physical fabric which expresses the Aqueduct's inventive structural design, including the use of reinforced concrete in the Considère system, its monumental scale and its distinctive form and design, influenced by the steel truss Firth of Forth bridge in Scotland (1890).

Aspects of the original system would be retained underground in the driven precast concrete piles, where the Considère system reinforcement was also employed, but would be concealed.

The demolition would mean the loss of a rare structure in Victoria, the last remaining of only two large-scale examples in the state of reinforced concrete structures using the Considère system, following the demolition in 1990 of the earlier Dennys Lascelles Austin Wool Store in Geelong (1910-11), also designed by Edward Giles Stone.

There is at least one other early E G Stone design in reinforced concrete surviving in Victoria, this is the James Minifie & Co. silo group at Lennon Street at South Kensington (1910-11), albeit it is a very different engineered structure and is not directly comparable or interchangeable with the Aqueduct's aesthetic and technical values.

Information about the Aqueduct's design would continue to be held, the structure is well-documented, evidence of its original design and construction survives in the form of original drawings and photographs and the structure has been the subject of extensive structural investigations. Additionally, the 'objects integral' provide additional physical evidence of the processes used in fabrication of concrete pipes for the outfall sewer. Extensive examples of the precast concrete pipes that Stone & Siddeley produced with innovative industrial processes at their Marshall Pipe Factory also remain in place underground, including some which were decommissioned and left in place near the Aqueduct following completion of the replacement siphon. Efforts are proposed to be made to retain sections of the Aqueduct pipe as well as artefacts from the Aqueduct's structural system through opportunistic salvage during demolition and debris removal.

The aesthetic significance of the structure as a major landscape feature in the Barwon River floodplain will be lost with its demolition. There is an intention to interpret the scale and alignment of the Aqueduct in the landscape through retention of the pier bases and construction of new interpretive elements, however this would be as a 'memory' of the structure and would only capture limited aspects of its landscape presence.

The historical associations of the Aqueduct with the establishment of Geelong's sewerage system (1912-15) and the longer history of the system are well-known and these will continue to be recognised through documentary and visual materials, as will the structure's association with Edward Giles Stone and Ernest J Siddeley. The Aqueduct's historical significance and associations would be recognised and referenced through the retained elements and expressive interpretation features at the heritage place.

As an intentional action, the demolition provides an opportunity to control how the memory of the place is perpetuated at the site. The proposal enables the Aqueduct's innovative engineering, contribution to public health and social history to be recognised and actively interpreted, a prospect less likely in a future scenario of gradual or uncontrolled collapse.

Mitigation / management measures

It is not possible to mitigate the impacts of the proposed demolition on the heritage significance of the place. Accepting this, measures are proposed that are directed at managing those impacts and achieving the best possible outcome in terms of acknowledging the Aqueduct's significance and promoting awareness of its key values.

Measure	Comment on mitigation
Heritage Interpretation Strategy	A **Heritage Interpretation Strategy** (Section 4.2) has been developed and would be implemented by Barwon Water as an integral component of the proposed project works. Interpretation cannot replace the loss of the original structure but provides a means through which the Aqueduct's former presence in this location can be referenced, with its heritage values recognised and given continued meaning. The Strategy seeks to translate aspects of those heritage values so that they can continue to be recognised at the place. The values would be addressed in both a historical sense (the place would continue to have cultural value as an interpreted historic site after the Aqueduct's demolition) and in what they offer in context for future management of the floodplain in partnership with Wadawurrung Traditional Owners. A package of measures has been identified, including a comprehensive approach to physical site-based interpretation, further physical interpretation and exhibitions to be located elsewhere and online, and commemorative events prior to demolition. In relation to the site-specific interpretation, it is important to note that this is a place where the absence of the original structure can be effectively interpreted. It is not a site that will be transformed through new development or intensive built form which would obscure the legibility of the original place and its setting and meanings. Rather, the open floodplain of the river valley will remain as a fundamental aspect of the place and the connection of that setting to the Aqueduct can be made legible through a variety of physical measures as well as supporting signage and digital information. This would be supported by the limited retention of footprint elements extending the original length of the current structure, and by proposed new built interpretation at the place. Within the cultural and community precinct and restored environment of Porronggitj Karrong, interpretation of the Aqueduct's history and other aspects of significance can be accommodated alongside Wadawurrung living cultural values and care for the land and water. As discussed below, opportunistic salvage of artefacts would also be undertaken to maintain tangible links that enhance the interpretive response.
Limited retention of footprint elements	As identified above, retention of limited elements of the Aqueduct's original structure is proposed in order to support continued recognition and interpretation of the heritage place. The elements to be retained are proposed to consist of: • Stair landings at the north and south ends of the structure, which mark where the Geelong Outfall Sewer entered and exited the bridge structure • Pier bases which currently support the 14 central piers of the truss spans. The Heritage Interpretation Strategy establishes principles for management of the retained footprint elements. All retained elements at the place would be made safe and able to be managed and maintained on a long-term continuing basis. In the case of the pier bases, these are planned to be cut down to below 1 metre in height, and restored and refinished with new concrete. Their interpretive value is proposed to be developed holistically to support the Aqueduct's historical meanings alongside appreciation of Wadawurrung living cultural values and contemporary use and care for Porronggitj Karrong.

Measure	Comment on mitigation
Opportunistic salvage of artefacts	Opportunities to salvage and retain elements of the structure in an artefactual form would also be exercised in the course of demolition, subject to the opportunities available once the structure has been brought safely to ground. For instance, it is anticipated that some ovoid pipe segments can be salvaged for display in this way, presented on the site or in other locations managed by Barwon Water. Subject to further investigations, the Heritage Interpretation Strategy identifies that some steel and concrete materials could be similarly salvaged on a limited basis for future display as part of exhibits addressed to the Aqueduct's structural design and materials. Artefactual salvage would serve to make tangible the site's residual connections to the Aqueduct's historical and technical values following demolition. There is the potential to display these artefacts both at the site itself and at other locations associated with the Geelong Sewerage Scheme, such as at the modern Black Rock Water Reclamation Plant and the low-level pumping stations in central Geelong. The Heritage Interpretation Strategy establishes principles for management and display of retained elements, including salvaged artefacts. As with the retained footprint elements, artefacts must be able to be cared for, and their use in interpretation, particularly on-site, must be developed holistically and support contemporary appreciation of the place's combined cultural values. Where not considered suitable for permanent display, other measures (such as recording) would be utilised.
Recording and documentation	An extensive photographic and digital three-dimensional recording programme has already been undertaken under the conditions of the 2020 heritage permit and in support of the permit implementation work and constructability investigations undertaken from 2021-2024. This includes: • **Ground-based and aerial (drone) photography** to Heritage Victoria's archival standards • **Drone-based three-dimensional 'photo spheres'** captured from the air along both sides of the structure • **Digital point cloud recording** of the structure, including photogrammetry. All these materials would be collated for permanent archiving under the conditions of the proposed heritage permit (if granted). In addition, the Heritage Interpretation Strategy identifies further actions which would support documentation of the heritage place's history and values, including: • **Oral history project** to identify and record the recollections and expressions of people with a long history of interaction with the Aqueduct, including former Trust / Water Board staff, engineering heritage specialists and other members of the Greater Geelong community. • **Cataloguing, digitisation and public archives accession** of historical documentation addressing the Aqueduct's engineering design and the history of its construction and maintenance, including major twentieth century repair programs (up to c. 1992) • **Historical publication of record** addressed to the Aqueduct's design, development and operation (and its institutional, technical and social history and significance). It is anticipated that this history could explore these topics in the context of European development at Geelong and of the Geelong waterworks and sewerage scheme, as well as the environment of Barre Warre Yulluk (Barwon River) and of Wadawurrung living cultural values and the future of Porronggitj Karrong.

5.2 Effect of a refusal on reasonable or economic use [s. 101(2)(b)]

In addressing the reasonable or economic use considerations, Heritage Victoria and the Heritage Council of Victoria prepared a policy 'Reasonable or economic use: relevant matters for the consideration of section 101(2)(b) of the Heritage Act 2017' (dated June 2021); the policy has been referred to in preparing this assessment.

Reasonable use

In relation to reasonable use, the policy notes as follows:

> The 'reasonable use' consideration is an objective assessment and is concerned with the reasonable use of the registered place or object, not what is subjectively reasonable. For example, refusal to issue a permit for an addition to a residence may affect the reasonable use of the registered place to a lesser extent if the place could generally be used as a residence by others without the proposed changes.

The policy goes on to set out factors the Executive Director may consider relevant to the circumstances of the application and the registered place or object:

> (1) the historic, recent and current uses of the registered place or object
>
> (2) other compatible uses of the registered place or object
>
> (3) the context and setting within which the place or object is located, and
>
> (4) other relevant matters.

In using the term *compatible use*, the policy refers to Article 11 of the Australia ICOMOS Charter for Places of Cultural Significance, 2013 (Burra Charter) – *Compatible use* means a use which respected the cultural significance of a place. Such a use involves no or minimal, impact on cultural significance.

The policy further notes that:

> Refusal to issue a permit for works to enable a change in use may affect the reasonable use of a place to a greater extent if the historic or recent use is now obsolete, than if the historic or recent use is not obsolete. For example, an adaptive re-use proposal for a now redundant industrial complex.

Comment

Addressing point (1) above, the function of the Aqueduct as a component in the Geelong Outfall Sewer was replaced in the early 1990s, when an underground siphon was constructed below the Barre Warre Yulluk (Barwon River) waterway on a separate alignment to the east of the Aqueduct. Since decommissioning, the Aqueduct has had no active use and now stands as an engineering heritage relic.

Addressing the question of compatible uses raised under (2), there are no realistic alternative uses for the Aqueduct itself. Even prior to recent risk assessments which affect the constructability of any form of stabilisation or repair works to the structure, past consideration of potential use as a public footbridge or similar found that this was not feasible because the dimensions of the Aqueduct, with its narrow central walkway, make it impossible to provide compliant or safe access without significant intervention.

As identified under (3), also of relevance in consideration of reasonable use is the context of the place. The presence and condition of the Aqueduct imposes substantial constraints on the reasonable use of the river and its environs as a significant landscape with environmental and cultural values, and as a recreational waterway. The Aqueduct is located over land which has been identified to be restored and developed as a cultural precinct and over the adjoining river channels. The presence of the Aqueduct, in its deteriorating and dangerous state, has since 1995 severely disrupted the ability to use the waterway and more recently has been identified as an impediment to ecological rehabilitation,

Traditional Owner access and public enjoyment of the surrounding land area. To date this issue has been managed through the isolation of the structure and security measures to prevent unauthorised access, however these measures along with the hazardous nature of the structure itself, impact the reasonable use of the land and waterway beneath the structure. Albeit that not all of the land or the waterway are included in the registration, the presence of the structure impacts on the reasonable use of its immediate environs and the broader environment of the river corridor.

The policy notes at (4) above that the Executive Director can consider any other relevant matter. In this case, it is suggested that the risks associated with retention of the structure are relevant to reasonable use. While a default position and one that was to have been maintained under the previous Heritage Victoria permit, the current 'function' of the Aqueduct as an engineering heritage relic in itself can be seen as a use that is no longer 'reasonable' because of the level of risk it presents in terms of public safety (in all scenarios) and occupational health and safety (in a works scenario).

Further, potential prospects for a future stabilisation or restoration of the structure (which shaped all previous proposals, studies and statutory decisions since the 1991 registration) have been thoroughly explored and effectively ruled out through the 2020 permit implementation project's extensive technical investigations and more detailed understanding of the structure's hazards and implications for safe construction. Given today's duties of care for worker and public safety, there can be considered to be no remaining reasonable prospect that a future stabilisation or repair of the Aqueduct will enable its retention as an engineering heritage relic to continue indefinitely.

From a cost perspective, there are significant direct costs associated with the management of risks associated with the Aqueduct, including maintenance of the exclusion area fencing and river booms, periodic inspections and public liability insurance. There is the potential for significant additional costs in the event of a substantial collapse of the structure or another adverse event, including costs in excess of the planned, controlled process of dismantlement and demolition proposed in the current application. Although cost is not a matter that has been material to Barwon Water's decision to make the current demolition proposal, it does go to the question of whether the status quo scenario can continue to be considered to be a reasonable use of the structure and site.

Economic use

Consideration of the economic use of a place, as addressed in the policy, relates to the economic functioning of the place and whether the proposed works would facilitate an economically sustainable use, including whether there is the ability for the place to generate income to cover costs associated with conservation.

In this proposal the works are directed at addressing safety risks and issues. Accordingly, matters of economic use are not considered to be relevant.

5.3 Effect of a refusal on duties of a public authority [s. 101(2)(d)]

A summary of the key relevant issues that apply to this consideration has been provided. Additional detail is included in the Position Statement prepared by Barwon Water which accompanies the permit application (refer to Annexure C).

Duties of the statutory authority

Barwon Water is established as a Water Corporation under the *Water Act 1989*, and is defined as a Regional Urban Water Authority and a Regulated Water Industry under the *Water Industry Act* 1994. It must comply with Water Industry Regulatory Order (WIRO). These acts and regulations serve to define Barwon Water's sources of revenue and the scope of the functions and services it delivers. Barwon Water's performance in respect to these acts is regulated by the Essential Services Commission (ESC) and Department of Energy, Environment and Climate Action (DEECA).

In the course of its normal operations, Barwon Water constructs and operates a variety of water and sewage infrastructure. This includes a number of operational places which are the subject of state and local heritage controls, including the Upper Stony Creek Reservoir (Golden Plains HO111; included in the Victorian Heritage Inventory (VHI),

the Cressy Water Tower (Colac Otway HO172) and the Lovely Banks Service Basins (Geelong HO1721). As the owner of this infrastructure, Barwon Water assumes the responsibility for its safe operation and for the responsible decommissioning and disposal of such assets once no longer required operationally, noting that unlike buildings, engineered infrastructure assets rarely present reasonable options for adaptation or sale, and would not otherwise be maintained in place following decommissioning. As with other public authorities, the management of redundant heritage structures is not an activity expressly contemplated in the provisions of the relevant acts under which Barwon Water operates. Any expenditure on such places necessarily has regard to the delivery of their core obligations/business.

Under the Water Act, Barwon Water has obligations in respect to the Barre Warre Yulluk (Barwon River) waterway that are shared with the Corangamite Catchment Management Authority (CCMA) and with other public authorities. It is also the direct owner of the land under and around the Aqueduct to the north of the river, and this includes obligations in relation to waterway and floodplain management both on land which Barwon Water owns directly as well as on Crown land and other land that may be affected through its activities. As part of this scope, the Water Act and the Minister's Letter of Expectations oblige Barwon Water to recognise and provide support for the exercise of Wadawurrung living cultural values and use of waterways and water resources, and for public recreational access to the waterway.

In exercising its duties, Barwon Water has further obligations established under the Water Industry Act 1994, including the Statement of Obligations (General). This includes obligations relating to (among other things):

- the preparation of plans, systems and processes to ensure risks associated with Barwon Water's functions are identified, assessed, prioritised and managed; and
- the preparation of plans, systems and processes to manage its assets in ways which maintain the standards and conditions and service and minimise the overall whole of life cost of providing service.

Barwon Water's management of the Aqueduct is required to be consistent with its obligations under the Water Act, Statements of Obligations and any plans prepared under the Statement of Obligations, as well as with duties established under the Heritage Act which apply to all owners of registered heritage places.

In addition to its primary statutory duties under the *Water Act 1989 and the Water Industry Act* 1994, Barwon Water also has legal obligations with respect to safety under the OHSA and the *Water Act (1989)*. These are set out in detail in the Barwon Water Position Statement at Annexure C.

In summary, the OHSA imposes a range of duties on employers in relation to the elimination (or control) of risks to health and safety in the workplace and matters arising from the conduct or undertaking of the employer. The key aspect of all duties is a requirement for employers to do what is reasonably practicable to eliminate or, where elimination is not reasonably practicable, reduce those risks to the extent reasonably practicable.

Importantly, OHSA offences (other than workplace manslaughter) are 'risk based'. That is, they do not require an incident to occur, and instead it is the mere existence of an identifiable risk to health and safety that has not been eliminated or controlled to the extent reasonably practicable that constitutes the criminal offending.

Employer duties imposed under the OHSA include requirements for employers to:

> so far as is reasonably practicable, provide and maintain for employees of the employer a working environment that is safe and without risks to health, which may be contravened by failing to:
>
> a) provide or maintain plant or systems of work that are, so far as is reasonably practicable, safe and without risks to health;
>
> b) maintain, so far as is reasonably practicable, each workplace under the employer's management and control in a condition that is safe and without risks to health,

so far as is reasonably practicable, monitor conditions at any workplace under the employer's management and control;

ensure, so far as is reasonably practicable, that persons other than employees of the employer (e.g. site visitors) are not exposed to risks to their health or safety arising from the conduct of the undertaking of the employer.

In addition, where a person who (whether as an owner or otherwise – e.g. Barwon Water) has, to any extent, the management or control of a workplace must ensure so far as is reasonably practicable that the workplace and the means of entering and leaving it are safe and without risks to health.

Effect of a refusal on the organisation's statutory duties

Where risks associated with works cannot be reasonably be eliminated or controlled, it is incumbent upon Barwon Water to make or request changes to the proposed works to enable risks to be eliminated or controlled to the extent reasonably practicable.

Investigations and risk assessments undertaken since 2020 have led to the determination that a safe working environment cannot be established and maintained while undertaking the structural propping required by the permitted project. This means that Barwon Water cannot implement the 2020 permitted project while satisfying its duties and obligations under the OHSA and the Water Act.

The alternative of retaining the Aqueduct in an unstabilised condition also presents significant continuing risks to public and employee safety, including those from spalling concrete and any future collapse of part or all of the structure. In contrast to previous heritage and engineering assessments undertaken over recent decades, it can no longer be reasonably stated that time will enable consequential repairs and rehabilitation of the Aqueduct's structure. In this context and despite the Aqueduct's significant heritage value, a decision to defer physical decommissioning and demolition of a hazardous utility structure is no longer acceptable while having regard to the organisation's statutory duties and obligations.

Today, a refusal of the application would compromise Barwon Water's ability to exercise and satisfy its primary statutory duties under the Water Act, including obligations in respect to:

- safe operation and responsible commissioning of its infrastructure
- waterway and floodplain management
- preparation of plans, systems and processes to identify and manage risk.

Critically, a refusal would also impact Barwon Water's ability to meet its obligations under the OHSA to keep the public safe and to provide a safe workplace, for which the criminal offence of workplace manslaughter now applies following 1 July 2020 changes to the legislation.

In summary, refusal of the permit application would unreasonably and detrimentally affect the ability of Barwon Water to meet its legal obligations with respect to the OHSA (duties of care to employees and the public) as well as its primary statutory duties under the Water Act.

6.0 Conclusions

6.1 Summary of assessment

A proposal for the complete (or effectively complete) demolition of a heritage structure of such high significance as the Ovoid Sewer Aqueduct remains a rare occurrence. Of even greater rarity is a scenario in which such a proposal represents the appropriate and necessary outcome from a heritage perspective; however this is the situation of the Aqueduct today.

Review of the current situation

The ambitious and highly innovative design and construction of the Aqueduct as completed in 1915 integrated within it a number of assumptions and material faults that made the structure subject to accelerated decay, experienced by 1922 and then in successive episodes thereafter. While the owning authority succeeded in stretching the operational life of the asset first to 50 and then 75 years, the alarming costs and risks of continuing repair and use of the Aqueduct compelled its operational replacement, with the sewer within the structure decommissioned in 1992. By that point the structure was in a hazardous condition, considered to have the potential to collapse at any time, and required the closure of both the land and river channels beneath it.

The arresting visual appearance of the structure and its adventurous engineering story have compelled a generation of advocacy in respect to its retention and future. Heritage assessments undertaken in 1991 and by the 1996 Panel of Inquiry recommended that demolition be delayed in order to provide time for political commitments, funding, technical advances and public interest to be brought to bear. It was hoped that these would underwrite the extensive and costly works required to return the Aqueduct to a state of good repair and prevent the restart of the progressive degradation that had afflicted the structure since its construction. The 1996 Panel report was also reliant on a difference of opinions among engineers informing the Panel as to the structure's risk of imminent collapse, and was made in a context in which the span that was then at greatest risk of collapse had been successfully propped.

None of the recommendations of the 1996 Panel subsequently were taken up; no other public agency or funding emerged to take ownership of the Aqueduct and the costs of repair and reconstruction; techniques for corrosion protection were trialled but did not change the requirement (and cost) to repair the failing concrete elements throughout the structure.

In this context, Barwon Water has over the subsequent 30 years both commissioned and facilitated a series of feasibility and technical investigations, including some funded by the Heritage Council of Victoria and other agencies within the Victorian government, which in overview all shared the following objectives:

- Explore the feasibility of potential repair programmes for the Aqueduct
- Reopen water and land-based access along the Barre Warre Yulluk (Barwon River) waterway
- Provide a safe and effective long-term basis for managed retention of the derelict structure and its site.

The various studies confirmed the high cost of an immediate programme of repairs (consistently above $20 million in today's dollars) and the infeasibility of funding these works through Barwon Water's capital and operational budgets as a water authority. As commented earlier, none of the studies were predicated on a detailed examination of the risks to safe construction during stabilisation and repair works. During this period, the statutory obligations, duties and penalties for negligence under Victoria's OHSA legislation were also formalised and expanded in comparison to liabilities for worker injury as existed in the 1980s and 1990s.

The 2020 heritage permit maintained the spirit of the 1996 Panel recommendations. The approved project, whose terms had been developed in post-application community reference between Heritage Victoria, Barwon Water and its consultant team, proposed to address the long overdue reopening of the river while creating what was intended at a minimum to be a safe and long-term basis for management of the Aqueduct as a stabilised ruin. From 2021 to 2024

Barwon Water worked intensively with its contractors, design engineers and heritage consultant to develop the propping designs, construction methodologies and control of the Aqueduct's collapse risk that would be required to safely implement the 2020 heritage permit. Unfortunately, the hazards to safe execution of the permitted construction works have been determined to be insurmountable. This profoundly affects the prospect that any other intervention could be made to safely stabilise or restore the structure and prevent its eventual collapse. With no other reasonable option remaining to retain and conserve the Aqueduct structure in whole or part, the owner has made the decision to apply for a permit for demolition.

Burra Charter context and heritage impact assessment

The Australia ICOMOS Burra Charter does not directly contemplate demolition as a response to the heritage significance and condition of a heritage place. Nevertheless, the Charter begins with important observations about the purpose of heritage conservation in its Preamble and in Article 2, identifying that:

> 'places of cultural significance must be conserved for present and future generations in accordance with the principle of inter-generational equity' (Preamble)
>
> 'the aim of *conservation* is to retain the *cultural significance* of a place' (Article 2.2), and
>
> '*Places* of *cultural significance* should be safeguarded and not put at risk or left in a vulnerable state' (2.4).

The Australian Heritage Council's guidance on the management of heritage ruins, written to be consistent with the Charter, does address scenarios in which 'removal has become inevitable' (reviewed in Section 3.3). Most of the scenarios it identifies are wholly consistent with the context in which the current application has been made.

Since the 1990s, the feasibility of physical stabilisation and conservation works for the Aqueduct as a heritage place have been extensively explored; as an outcome of the 2020 heritage permit the prospect of the safe execution of any such works has now also been investigated and assessed in detail. The conclusion of the latter investigations is that there is no longer a reasonable prospect that the structure can be restored or stabilised to the extent that its future (potentially catastrophic) loss can be prevented. This is a conclusion that addresses the impracticality and inadvisability of *any* party or agency undertaking works assessed to be unsafe; it also reflects the considerations of Barwon Water as the owner of the structure and a part of the land, and as a public authority with duties under both the Water Act and the OHSA.

Until recently, alternative scenarios were contemplated involving long-term physical conservation for all or part of the Aqueduct, today, however, there are only two remaining futures that can be foreseen for the place:

- the Aqueduct's continued deterioration and physical hazard within a fenced exclusion zone until its inevitable collapse
- intentional, careful demolition at a point in time in which the Aqueduct's heritage significance can be recorded, celebrated and addressed through new works and activities both at the heritage place and in other venues.

The first of these does not allow Barwon Water to meet its obligations under the OHSA.

Additionally, no heritage best practice identifies that the retention of a hazardous structure should be favoured when the hazard cannot be prevented or controlled, presents foreseeable risks of injury to people, the environment or other cultural values, and would inevitably lead to the loss of the place.

After having exhausted all other possibilities, the proposed demolition and interpretation of the Ovoid Sewer Aqueduct is the only remaining option to look after the heritage place and perpetuate its heritage significance.

The heritage impact of demolition would be profound, but not total. Elements of the original structure would be retained on site for their interpretive value, and new interpretive features constructed, which would help to recognise

some of the values for which the place was registered. Additionally, the Aqueduct's history and its relationship to the Greater Geelong and Victorian communities would also be explored through new off-site programming.

6.2 Recommended permit conditions

Subject to a determination by the Executive Director to grant a heritage permit for the proposed demolition and interpretation of the Aqueduct, permit conditions are recommended that would support heritage conservation objectives. Suggested conditions and draft language are provided in Table 1 below.

Table 1 Recommended heritage permit conditions

Condition subject	Suggested language/requirements
Expiry dates	As typically required, with the following suggested timeframes: • Pre-commencement expiry: two (2) years from the date of issue • If not completed expiry: six (6) years from the date of issue
Notice of commencement	As typically required.
Staging Plan	A condition which would allow for approval of a Staging Plan and subsequently staged submission and endorsement of construction documentation in accordance with this. At a minimum, the project stages are expected to include site establishment, principal demolition works, conservation and adaptation works for the Aqueduct's retained footprint elements, and on-site interpretation.
Heritage Interpretation Plan	A condition requiring, within 12 months of permit issue, submission of a Heritage Interpretation Plan (HIP) for the Executive Director's approval. The HIP should be in general accordance with the Aqueduct Heritage Interpretation Strategy, provide additional detail and respond to the findings of feasibility investigations and stakeholder consultation and engagement. The submitted HIP should include concept designs for all proposed on-site interpretation elements, associated works and infrastructure, and confirm the scope and timeframes for the off-site programme, including programme components to be delivered both before and after demolition.
Construction documentation	A condition requiring submission of for-construction documentation for endorsement prior to commencement of each stage of works identified in the approved Staging Plan.
Interpretation Programme Outcomes	A condition requiring submission of a report for the Executive Director's approval that reviews the initial outcomes of the Aqueduct heritage interpretation programme as implemented during the heritage permit, their implications for the heritage significance and VHR registration of the post-demolition Aqueduct site (including the objects integral), and provides recommendations for any further programming or other heritage-related measures. The report should be prepared by a suitably qualified Heritage Consultant.
Notice of completion	As typically required.
Minor changes provisions	As typically provided.

ENDNOTES

1 As listed in an inventory dated January 2023, which is held by the Executive Director, Heritage Victoria.

2 David Rowe, *About Corayo: A thematic history of Greater Geelong*, City of Greater Geelong, 2021, p.472

3 Contract No. 4, Report & recommendations on tenders received for the manufacture and erection of an aqueduct across Barwon River, Geelong,' 23 September 2012, p. 2

4 Contract No. 4, Report & recommendations on tenders received for the manufacture and erection of an aqueduct across Barwon River, Geelong,' 23 September 2012, pp. 6-8

5 Contract No. 4, Report & recommendations on tenders received for the manufacture and erection of an aqueduct across Barwon River, Geelong,' 23 September 2012, p. 10

6 Leigh Edmonds, *Living by Water: a history of Barwon Water and its predecessors*, 2005, pp. 377-378

7 Taywood-Maunsell, Structural Integrity Assessment of Barwon River Ovoid Sewer Aqueduct, April 1991, p.20

8 Beauchamp Consulting Engineers submission to 1996 Panel of Inquiry, pp. 4-5.

9 C C Breen correspondence, 13.6.22, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

10 J A Laing correspondence, 24.7.22, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

11 Sharland memo, 22 June 23, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

12 E G Stone, 'Report upon inspection of Reinforced Concrete Aqueduct over the Barwon River at Geelong,' received 23 August 23, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

13 Sharland record of interview with Stone, 5 November 1923, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

14 E G Stone, 'Report upon inspection of Reinforced Concrete Aqueduct over the Barwon River at Geelong,' received 23 August 23, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

15 E G Stone correspondence 10 September 23, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

16 R T McKay correspondence 14 March 1924, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

17 Sharland memo, 28 March 1924, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

18 Sharland Memo, 30 May 1924, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

19 Sharland letter, 28 May 1924, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

20 C C Breen, 9 April 1930, in 'Repairs to Barwon River Aqueduct 1922-1924,' Barwon Water Archives 45/001/A0031, Box 1

21 G J G Vines memorandum, 5 April 1974, Barwon Water Archives 45/001/A0003

22 G J G Vines memorandum, 5 April 1974, Barwon Water Archives 45/001/A0003

23 Report from the Engineer-in-Chief, 7 February 1977, 'Ovoid Sewer Aqueduct – Structural Repairs,' in Barwon Water Archives 45/001/A0003

24 9 February 1977 correspondence, Barwon Water Archives, 45/001/A0003

25 Sewerage Contract no. 418 Schedule of Quantities and Rates, Barwon Water Archives

26 A Willingham, The Ovoid Sewer Aqueduct at Breakwater Geelong Victoria: Assessment of Cultural Significance, Preparation of a Conservation Management Plan, June 1991, p. 12

27 Taywood-Maunsell, Condition Assessment of Barwon River Ovoid Sewer Aqueduct, March 1990, p. 12

28 Taywood-Maunsell, Condition Assessment of Barwon River Ovoid Sewer Aqueduct, March 1990, p. 1

29 Taywood-Maunsell, Condition Assessment of Barwon River Ovoid Sewer Aqueduct, March 1990, p. 12

30 Taywood-Maunsell, Condition Assessment of Barwon River Ovoid Sewer Aqueduct, March 1990, p. 19

31 Taywood-Maunsell, Structural Integrity Assessment of Barwon River Ovoid Sewer Aqueduct, April 1991, p.68

32 Beauchamp Consulting Engineers submission to 1996 Panel of Inquiry, p. 8

33 A Willingham, The Ovoid Sewer Aqueduct at Breakwater Geelong Victoria: Assessment of Cultural Significance, Preparation of a Conservation Management Plan, June 1991, p. 15

34 Harwood & Pincott correspondence, 4 September 1991 in Barwon Water archives 15/140/0001S

35 J Moles, Barwon Sewer Aqueduct: Report by Independent Panel of Inquiry, May 1996, pp. 6-7

36 Maunsell Pty Ltd correspondence, 7 August 1995 in Barwon Water archives 45/140/0001

37 Maunsell Pty Ltd correspondence, 10 October 1995 in Barwon Water archives

38 Harwood Andrews correspondence, 11 October 1995 in Barwon Water archives

39 J Moles, Barwon Sewer Aqueduct: Report by Independent Panel of Inquiry, May 1996, p. 40

40 J Moles, Barwon Sewer Aqueduct: Report by Independent Panel of Inquiry, May 1996, pp. ii-iii

41 J Gard'ner correspondence 23 March 2010, Barwon Water archives

42 J M Macintyre correspondence 3 October 1957, p.2, Barwon Water archives

43 Taywood-Maunsell, *Structural Integrity Assessment of Barwon River Ovoid Sewer Aqueduct*, 1991, p. 68

44 Maunsell Pty Ltd correspondence 7 September 1995, Barwon Water archives

45 Preamble to heritage permit P32806

46 Condition 10, heritage permit P32806

47 Arup, Barwon Aqueduct Structural Engineering and Risk Assessment (Annexure A), p. 29

48 Structex, *Barwon Ovoid Sewer Aqueduct*, March 2025 rev 4, p.12

49 Structex, *Barwon Ovoid Sewer Aqueduct*, March 2025 rev 4, p.14

50 Structex, *Barwon Ovoid Sewer Aqueduct*, March 2025 rev 4, p.18

51 Australia ICOMOS Burra Charter, Article 1, Definitions, p. 2.

52 Australian Heritage Council, *Ruins a guide to conservation and management*, 2013, p. 36

53 Australian Heritage Council, *Ruins a guide to conservation and management*, 2013, p. 36

APPENDIX A

Heritage Permit P32806, as amended

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AMENDED HERITAGE PERMIT

ISSUED UNDER SECTION 105B OF THE HERITAGE ACT 2017

Permit No: P32806 **(AMENDED)**

Applicant: Barwon Water
Cat Mcconkey
55-67 Ryrie St
Geelong VIC 3220

NAME OF PLACE/OBJECT:	OVOID SEWER AQUEDUCT OVER BARWON RIVER
HERITAGE REGISTER NUMBER:	H0895
LOCATION OF PLACE/OBJECT:	140 TANNER STREET BREAKWATER AND 91-97 TANNERY ROAD CHARLEMONT, GREATER GEELONG CITY

THE PERMIT ALLOWS: Demolition of four (4) of the fourteen (14) pier and truss spans, and retention of the four (4) associated pier base structures, removal of the existing exclusion fencing, establishment of an expanded public exclusion zone and new fencing and delivery of a heritage interpretation program, in accordance with the following documents, as endorsed by the Executive Director and forming part of this permit:

- **Barwon River Sewer Aqueduct structural drawings, job no. 267246, prepared by arup**
  - **Drawing no. S-0001 Cover sheet and drawing list, Issue P2, 06/04/2020**
  - **Drawing no. S-1001 demolition and exclusion zone fencing, issue P3, 06/04/2020**
  - **Drawing no. S-1002 long section, issue p3, 06/04/2020**
  - **Drawing no. s-1003 proposed propping details at pier 8, issue p3, 06/04/2020**
  - **Drawing no. s-1004 proposed propping details at pier 13, issue p1, 05/02/2020**
  - **Drawing no. s-1005 typical prop details, issue p1, 05/02/2020**
- **Barwon Water Ovoid Sewer Aqueduct: Proposed partial demolition, Heritage Interpretation Overview, prepared by Lovell Chen, April 2020**

THE FOLLOWING CONDITIONS APPLY TO THIS PERMIT:

1. The permission granted for this permit shall expire if one of the following circumstances applies: the permitted works have not commenced within two (2) years of the original date of issue of this permit, or are not completed within ~~four (4)~~ eight (8) years of the original date of issue of this permit unless otherwise agreed in writing by the Executive Director, Heritage Victoria (**the Executive Director**).

2. The Executive Director is to be given five working days' notice of the intention to commence the approved works.

3. The works approved in this permit must be undertaken in a staged manner. These stages are: **Stage 1 Early-Works Package** (such as site establishment and clearance, removal of hazards, geotechnical investigations and the like, where it relates to registered land); **Stage 2 Conservation Works Package** associated with maintenance, repair, propping and make safe works to the extent of reasonably avoiding catastrophic collapse to the Aqueduct structure; **Stage 3 Demolition Package** associated with the river spans of the Aqueduct structure and permanent end propping of

the newly created truss ends.

PRIOR TO COMMENCEMENT OF ANY WORKS

4. Prior to the commencement of any of the works approved by this permit, a suitably experienced **Structural Engineer** is to be nominated in writing for endorsement by the Executive Director. The nominated and approved Structural Engineer shall be appointed by the permit holder to prepare advice on appropriate measures to ensure the protection and structural stability of the heritage place prior to and during the undertaking of the works, and assist with the fulfillment of the conditions of this permit. The Structural Engineer is to undertake regular inspections throughout the duration of the works to ensure the Aqueduct and its propping is not compromised. The Executive Director is to be informed immediately if the structural stability of the Aqueduct is threatened.

5. Prior to the commencement of any of the works approved by this permit, a suitably experienced **Heritage Consultant** is to be nominated in writing for endorsement by the Executive Director. The nominated and approved Heritage Consultant shall then be appointed by the permit holder to provide advice to assist with the fulfillment of works and conditions of this permit. The endorsed Heritage Consultant shall advise the permit holder on appropriate means of achieving minimal detriment to significant fabric by compliance with best conservation practice and the conditions of this permit.

6. Prior to the commencement of any of the works approved by this permit, **vibration monitoring equipment** must be installed as a precautionary measure to ensure vibration levels are monitored and maintained within acceptable levels (as determined between the experts nominated at conditions 4 and 5) to protect the Aqueduct structure (including propping) from damage and/or catastrophic collapse. Regular clear and concise vibration monitoring updates are to be provided to the Executive Director throughout the three stages of the works as reassurance that the vibration levels are maintained within acceptable levels to ensure the ongoing stability of the Aqueduct and its propping. The following must be submitted for the endorsement of the Executive Director and once endorsed becomes part of the permit:

a) Plan(s) showing the location of vibration monitoring equipment;

b) A schedule of vibration monitoring updates;

c) Information to clarify what acceptable level has been determined;

d) An outline of what measures and protocols have been put in place if the vibration threshold is approached or exceeded.

7. Prior to and during works a formal **Program of Recording** of the heritage place is to be undertaken. This consists of a **Photographic Archival Survey**, recording using a **three-dimensional technology** and a **Demolition Recording Specification**. These requirements are covered at conditions 8, 9, 21, 25, 26 and 32. The Program of Recording is to provide: a record of the complete heritage place prior to the works; the current condition (including major defects in the fabric) of the Aqueduct structure; the full length of the Aqueduct structure including the spans proposed for demolition; record any important information revealed through the works for use as part of the **Part 2 Heritage Infrastructure Management Plan** (required at condition 31) and for use as part of the **Heritage Interpretation Plan** (required at condition 34) and to record the works as completed.

8. Prior to the commencement of any of the works approved by this permit, an archival quality photographic survey is to be prepared to record the heritage place. This is to be prepared in two parts. The **Part 1 Photographic Archival Survey** (Part 1 Survey) is to be the primary means of recording the heritage place prior to works commencing. The Part 1 Survey is to be prepared in accordance with the Heritage Council/Heritage Victoria Technical Note entitled "Photographic Recording for Heritage Places and Objects" (available on the Heritage Council website or from Heritage Victoria on request) or any subsequent update of this document. The Part 1 Survey must also include high quality still drone footage to capture the place from above, including its full length and shorter detailed sections, particularly the river spans. A single copy of the Part 1 Survey is to be provided to the Executive Director in electronic (hard drive) format only, who will advise in writing if it satisfies this condition. Full and final submission of this record is required at condition 32.

9. Prior to commencement of any of the works approved by this permit, a recording using a **three-dimensional technology** (such as 3D scan, 3D image capture, photogrammetry or similar) of the full length of the Aqueduct structure must be undertaken and submitted digitally in a readily available format to the Executive Director for approval in writing. The intention of this record is for use as part of the **Heritage Interpretation Plan** for the heritage place required at condition 34. Full and final submission of this record is required at condition 32.

PRIOR TO COMMENCEMENT OF STAGE 1 EARLY-WORKS PACKAGE

10. Prior to the commencement of **Stage 1 Early-Works Package** approved by this permit, a Construction Management Plan (the Plan) must be provided for endorsement by the Executive Director and once endorsed becomes part of the permit. The Plan must include:

a) A sequencing program for the approved works;

b) Details of any temporary infrastructure and services required;

c) A work site layout plan;

d) Protection methods for the heritage place during the undertaking of the works;

e) Advice of the Structural Engineer and Heritage Consultant nominated at conditions 4 and 5 on appropriate protection methods for the heritage place during the undertaking of the works.

11. Prior to commencement of **Stage 1 Early-Works Package** a tender ready set of plans documenting these works must be submitted for endorsement by the Executive Director and once endorsed becomes part of the permit.

12. Should minor changes in accordance with the intent and approach of the permitted works approved for the **Stage 1 Early-Works Package** and endorsed documentation (condition 11) become necessary, correspondence and supporting documentation must be prepared and lodged in accordance with this permit condition for assessment by the Executive Director. More fulsome or major changes to the permit may require the submission of a permit amendment application to Heritage Victoria.

PRIOR TO COMMENCEMENT OF STAGE 2 CONSERVATION WORKS PACKAGE

13. A **Heritage Infrastructure Management Plan** (HIMP) for the Ovoid Sewer Aqueduct must be prepared as part of this permit to identify the physical interventions required and their

recommended scheduling to achieve the ongoing and long-term maintenance and conservation of the heritage place. The HIMP is to be compiled by the Heritage Consultant and Structural Engineer nominated at condition 4 and 5, or a qualified heritage conservation and engineering professional agreed in writing by the Executive Director. There will be two components to the HIMP required at two stages during the approved works outlined at conditions 13, 14 and 31. The **Part 1 HIMP** is required to be prepared prior to works starting on **Stage 2 Conservation Works Package**. The **Part 2 HIMP** is required to be prepared at the conclusion of **Stage 3 Demolition Works Package**. A **Bank Guarantee** secures the preparation of Part 1 and Part 2 of the HIMP (required at condition 15). Within ~~6 months~~ 4 years of endorsement of the Part 1 HIMP by the Executive Director, the obligations in the Part 1 HIMP are to be made legally binding on the owner of the registered land by means of the owner entering into a **Covenant** with the Heritage Council of Victoria pursuant to the relevant provisions of Part 7 of the *Heritage Act 2017* (required at condition 16).

14. Part 1 HIMP must be prepared and submitted for the endorsement of the Executive Director prior to the commencement of **Stage 2 Conservation Works Package** approved by this permit, and once endorsed becomes part of this permit. The Part 1 HIMP must include the following:

a) An Action Plan that can be implemented in the event of catastrophic or structural collapse and for disasters or emergency events. This must include but may not be limited to:

i) Plans to prepare the heritage place for known disaster events such as floods;

ii) A catastrophic collapse, disaster or emergency response informed by the documented significance of the heritage place including an approach to safeguarding any elements at risk as a result of the unforeseen event;

iii) Decision-making matrix and Plans as to the requirement for safely storing any significant material or artefacts that are dislodged, in a weather-tight location on site or elsewhere;

iv) Plans for emergency and construction vehicle access;

v) Plans for restricting public access;

vi) Decision-making matrix and approach for clearing part of site if a major collapse occurs; and

vii) Plans for securing the structural integrity of the overall structure such as any requirement for new structural propping as a result of an event.

b) A schedule of ongoing maintenance, repair and/or make safe works to the retained Aqueduct spans and their propping to the extent of reasonably avoiding catastrophic collapse;

c) A schedule of ongoing landscape maintenance works required to protect the Aqueduct, retained pier bases and the propping including but not limited to vegetation clearance and/or limitations on plantings directly adjacent to the Aqueduct, its pier bases or propping. It is preferable that the landscape is maintained in a similar manner within the full extent of the exclusion zone (as defined by the fencing).

d) A schedule for inspections and reporting to be provided to Heritage Victoria in perpetuity. Initially these are to be every 6 months for the first five years and preferably undertaken by the Heritage Consultant and/or Structural Engineer nominated at condition 4 and 5. After the initial 5 years they are to be provided yearly and undertaken by a qualified heritage conservation and/or engineering professional agreed in writing by the Executive Director. The intention of these reports is to monitor the condition of the Aqueduct structure and its propping as well as the retained pier bases. The Executive Director, or their representative, are to be invited for yearly inspections that generally follow the scheduling of reporting.

e) Recommendations for standing permit exemptions under section 92 of the *Heritage Act 2017* to allow regular maintenance works documented in the HIMP to be undertaken at the heritage place.

15. Prior to preparation of the **Heritage Infrastructure Management Plan** (HIMP) required at condition 13, 14 and 31, a costed schedule or itemised quote from the consultant(s) for the preparation of this document (Part 1 and Part 2) is to be lodged and approved in writing by the Executive Director. An **unconditional Bank Guarantee** made out to the Heritage Council of Victoria (ABN 87 967 501 331) for the amount of the works identified in the approved costed schedule or itemised quote plus a 10% contingency amount. The bank guarantee is required to ensure satisfactory completion of the **Part 1 and Part 2 HIMP** required by this permit. The Bank Guarantee will be forfeited if the Part 1 and Part 2 HIMP (as required at conditions 13, 14 and 31) are not completed or if Part 1 HIMP is not Covenanted to the title of the heritage place (as required at condition 16). The Bank Guarantee will be returned on satisfaction of conditions 13, 14, 16 and 31.

16. Within ~~**6 months**~~ ~~**18 months**~~ 4 years of endorsement of the **Part 1 Heritage Infrastructure Management Plan** (Part 1 HIMP) in accordance with condition 14, the obligations of the **Part 1 HIMP** are to be made legally binding on the owner of the registered land/structure by means of the owner entering into a **Covenant** with the Heritage Council of Victoria pursuant to the relevant provisions of Part 7 of the *Heritage Act 2017*. The approved Part 1 HIMP endorsed with condition 14 shall be incorporated into the Covenant. Reasonable investigations must be made by the permit holder and provided to the Executive Director to have the Covenant (or an equivalent binding agreement) attached to all titles that contain the registered structure and/or land. In doing so the permit holder must note to each owner that the obligations of the Covenant regarding Part 1 of the HIMP apply to the permit holder only. To satisfy this permit condition the permit holder is required to provide the title(s) of the registered land/structure that has the Covenant recorded against it and on receipt fulfillment of this condition will be confirmed in writing by the Executive Director.

17. Once endorsed, the works documented in the **Part 1 HIMP** at condition 14 are to be undertaken for the duration of the validity of this permit, or until the requirements are fulfilled regarding the Covenant required at condition 16. Before the expiry of this permit, an application is to be made to Heritage Victoria for the standing permit exemptions documented in condition 14. e) in accordance with section 92(3) of the *Heritage Act 2017*.

18. Prior to commencement of **Stage 2 Conservation Works Package**, should any early-works associated with this stage be required, a tender ready set of plans documenting these works must be submitted for the endorsement of the Executive Director and once endorsed becomes part of the permit.

19. Prior to the commencement of **Stage 2 Conservation Works Package** approved by this permit, a Construction Management Plan (the Plan) must be provided for endorsement by the Executive Director and once endorsed becomes part of the permit. The Plan must include:

a) A sequencing program for the approved works;

b) Details of any temporary infrastructure and services required;

c) A work site layout plan;

d) Protection methods for the heritage place during the undertaking of the works;

e) Advice of the Structural Engineer and Heritage Consultant nominated at conditions 4 and 5 on appropriate protection methods for the heritage place during the undertaking of the works.

20. Prior to commencement of **Stage 2 Conservation Works Package** a tender ready set of Plans documenting the works must be submitted for the endorsement of the Executive Director and once endorsed becomes part of the permit. This must include the construction methodology and plans for propping of the Aqueduct to be retained including any enabling works required to facilitate this. The purpose of Stage 2 Conservation Works Package is to undertake conservation works that will reasonably avoid the catastrophic collapse of the Aqueduct structure, taking into consideration the flood prone nature of the site, the forthcoming demolition works, and to secure the long-term future of the structure. This must also include the relevant works identified in the **Part 1 HIMP** at condition 14. Prior to submission, these plans must be approved by the Structural Engineer specified at condition 4. These plans may also include the construction methodology and plans for the permanent end propping and finishing works to the newly created truss ends as part of **Stage 3 Demolition Works Package**.

21. While undertaking the works in Stage 2 Conservation Works Package, the **Part 2 Photographic Archival Survey** (Part 2 Survey) (final submission required at condition 32) is to be undertaken to photographically document the structure during the Stage 2 Conservation Works Package. The Part 2 Survey is to be prepared in accordance with the Heritage Council/Heritage Victoria Technical Note entitled "Photographic Recording for Heritage Places and Objects" (available on the Heritage Council website or from Heritage Victoria on request) or any subsequent update of this document. The intention of the Part 2 Survey is to incorporate in the full Photographic Archive Survey any revealed fabric, finishes, materials or latent conditions found on site during the undertaking of the propping and associated works, and as well as the works as completed at the heritage place in the Stage 2 Conservation Works Package.

22. Should minor changes in accordance with the intent and approach of the permitted works approved for the **Stage 2 Conservation Works Package** and endorsed documentation (condition 20) become necessary, correspondence and supporting documentation must be prepared and lodged in accordance with this permit condition for assessment by the Executive Director. More fulsome or major changes to the permit may require the submission of a permit amendment application to Heritage Victoria.

23. Prior to any further stages of the approved works proceeding, the **Stage 2 Conservation Works Package** must be completed to an extent established in the Construction Management Plans endorsed at conditions 19 and 27 and on the basis of the advice of the Structural Engineer nominated at condition 4; this is to be a minimum of two truss spans beyond both ends of the demolition works. To satisfy this part of the permit condition, **an interim report by the Structural Engineer** specified at condition 4 must be provided on completion of the propping to the initial hold point endorsed at conditions 19 and 27, documenting how the works completed will reasonably control the potential of the demolition works to impact the retained sections of the structure, to the satisfaction of the Executive Director. **A final report by the Structural Engineer** specified at condition 4 must be provided on the final completion of the works endorsed at condition 20, documenting how the works will reasonably avoid catastrophic collapse of the Aqueduct structure in accordance with the considerations outlined at condition 20, to the satisfaction of the Executive Director. At the time of the interim report, the full completion of propping to the newly created truss ends required as part of demolition works, and to the next adjoining truss not yet propped, may not be required to be in place to satisfy this permit condition if they are dependent on the commencement and delivery of Stage 3 Demolition Works Package or on the progress of the balance of Stage 2 Conservation Works.

PRIOR TO THE COMMENCEMENT OF STAGE 3 DEMOLITION WORKS PACKAGE

24. Prior to commencement of **Stage 3 Demolition Package**, should any early-works associated with this stage be required, a tender ready set of plans documenting these works must be submitted for endorsement by the Executive Director and once endorsed becomes part of the permit.

25. A **Demolition Recording Specification** for the recording of the structure during demolition, prepared by a suitably qualified expert(s) is a requirement of the formal **Program of Recording**. To inform this the permit holder must provide to the Executive Director for approval in writing a schedule of the key milestones that should be documented as defined by the construction methodology outlined at condition 28. The intention of the Demolition Recording Specification is to provide research into the material composition of the structure to inform the **Part 2 HIMP** (required at condition 31) and for use as part of the **Heritage Interpretation Plan** for the heritage place (required at condition 34) and as part of the final **Photograph Archival Survey (**required at condition 32).

26. Prior to the commencement of works on **Stage 3 Demolition Package**, the **Demolition Recording Specification** for the recording of the structure during demolition, prepared by a suitably qualified expert(s) must be provided for endorsement by the Executive Director and once endorsed becomes part of the permit. The works in the endorsed Demolition Recording Specification must be undertaken during Stage 3 of the works. This Specification must include but not be limited to:

a) **Part 3 Photographic Archival Survey** (Part 3 Survey) (final submission required at condition 32) to photographically document the structure during and following the Stage 3 Demolition Works Package. The Part 3 Survey is to be prepared in accordance with the Heritage Council/Heritage Victoria Technical Note entitled “Photographic Recording for Heritage Places and Objects” (available on the Heritage Council website or from Heritage Victoria on request) or any subsequent update of this document. The intention of the Part 3 Survey is to incorporate in the full Photographic Archive Survey any revealed fabric, finishes, materials or latent conditions found on site during the undertaking of the demolition works, and as well as the works as completed at the heritage place in the Stage 3 Demolition Works Package.

b) Use of time capture and/or moving image to record the partial demolition;

c) Recording of the internal condition of the pipe;

d) Information about the material composition, deterioration and any other relevant matter associated with the structure revealed during the partial demolition works;

e) Artefact retention and conservation policies.

27. Prior to the commencement of **Stage 3 Demolition Package** approved by this permit, a Construction Management Plan (the Plan) must be provided for endorsement by the Executive Director and once endorsed becomes part of the permit. The Plan must include:

a) A sequencing program for the approved works;

b) Details of any temporary infrastructure and services required;

c) A work site layout plan;

d) Protection methods for the heritage place during the undertaking of the works;

e) Advice of the Structural Engineer and Heritage Consultant nominated at condition 4 and 5 on appropriate protection methods for the heritage place during the undertaking of the works.

28. Prior to the commencement of **Stage 3 Demolition Package** a tender ready set of Plans documenting the demolition works must be submitted for the endorsement of the Executive Director and when endorsed becomes part of the permit. The drawings must include:

a) The demolition methodology and Plans including the proposed management of any sections of the structure proposed to be salvaged, recorded and/or investigated in accordance with the Demolition Recording Specification approved at condition 25 and 26;

b) The construction methodology and Plans for the permanent end propping and finishing works to the newly created truss ends (if not already endorsed through condition 20);

c) The construction methodology and Plans for retaining pier bases which documents any associated works to make the retained pier bases safe;

d) Plans detailing the expanded exclusion zone fencing, including final material selection on the advice of the Heritage Consultant that reduces as much as possible the visual impact of the fencing in the long views to the structure.

29. Should minor changes in accordance with the intent and approach of the permitted works approved for the **Stage 3 Demolition Package** and endorsed documentation (condition 28) become necessary, correspondence and supporting documentation must be prepared and lodged in accordance with this permit condition for assessment by the Executive Director. More fulsome or major changes to the permit may require the submission of a permit amendment application to Heritage Victoria.

AT COMPLETION OF STAGE 3 DEMOLITION WORKS PACKAGE

30. The Executive Director must be notified in writing of the completion of the **Stage 3 Demolition Works Package.**

31. Part 2 HIMP must be completed at the conclusion of **Stage 3 Demolition Package**, and prior to satisfaction of condition 37. Once completed the Part 2 HIMP is to be submitted to the Executive Director for endorsement and once endorsed forms part of the permit. This must be prepared to document proposed options and sequencing of conservation works, including their approximate costings, that may be implemented in the future. The Part 2 HIMP must be informed by the investigations revealed as part of the **Demolition Recording Specification** at condition 25 and 26. The intention of the Part 2 HIMP is to provide a realistic and costed schedule of conservation works that may be used by Barwon Water to apply for funding in the future or handed over and implemented by another group in the future. Satisfaction of this condition (and condition 14) will allow the return of the Bank Guarantee at condition 15.

32. At the completion of **Stage 3 Demolition Package**, and prior to the fulfilment of condition 37, a digital copy of the completed Part 2 and Part 3 **Photographic Archival Survey**, prepared in accordance with conditions 21 and 26 is to be submitted to the Executive Director for approval in writing. On approval two copies of the fully completed **Photographic Archival Survey** (Part 1, Part 2 and Part 3) are to be prepared in accordance with the Heritage Council/Heritage Victoria Technical Note entitled “Photographic Recording for Heritage Places and Objects” (available on the Heritage Council website or from Heritage Victoria on request) or any subsequent update of this

document. Two hard drives are also to be prepared with the **three-dimensional technology record** approved at condition 9 in a digital format recommended in the National Archives of Australia Digital Preservation Policy. One full set (completed Photographic Archival Survey and the three-dimensional technology record) is to be lodged with Heritage Victoria and the other to the La Trobe Picture Collection, 328 Swanston Street Melbourne 3000, State Library of Victoria or delivered by courier to Despatch: 174 Little Lonsdale Street Melbourne 3000, deliveries accepted from 7.30am to 4.30pm. A receipt will be sent from the State Library of Victoria the day the material is received, a copy of which is to be sent to Heritage Victoria by the permit holder. This condition will be satisfied once the Executive Director confirms receipt of the Heritage Victoria set, and final lodgement with the State Library of Victoria.

33. Prior to preparation of the **Heritage Interpretation Plan** required at condition 34, a costed schedule or itemised quote from the consultant(s) for the preparation of this document is to be lodged and approved in writing by the Executive Director. An **unconditional Bank Guarantee**made out to the Heritage Council of Victoria (ABN 87 967 501 331) for the amount of the works identified in the approved costed schedule or itemised quote plus a 10% contingency amount. The bank guarantee is required to ensure satisfactory completion of the Heritage Interpretation Plan required by this permit. The Bank Guarantee will be forfeited if the Heritage Interpretation Plan is not prepared to the satisfaction of the Executive Director. The Bank Guarantee will be returned together with the Bank Guarantee secured at condition 36 on the implementation of the Heritage Interpretation Plan endorsed at condition 34 through satisfaction of condition 35.

34. A **Heritage Interpretation Plan** for the heritage place must be prepared by a suitably qualified and experienced practitioner and be submitted to the Executive Director for endorsement within 12 months of completion of the **Stage 3 Demolition Works** (based on satisfaction of condition 30), unless otherwise agreed in writing by the Executive Director. The Heritage Interpretation Plan must be generally in accordance with the 'Barwon Water Ovoid Sewer Aqueduct: Proposed partial demolition, Heritage Interpretation Overview' prepared by Lovell Chen, April 2020. It should be aspirational and go beyond the provision of signage on the site. It should be developed in consultation with community and expert stakeholders and include but not be limited to proposals for the appropriate and publicly accessible interpretation of: the historic, scientific (technical) aesthetic and architectural significance of the heritage place; the loss of the spans crossing the Barwon River (including reasons why); the full length of the original Aqueduct structure (at the registered site and at any other relevant location); the conservation methods used to protect and maintain the heritage place, including propping. It must also make use of the information and research gathered as part of the formal **Program of Recording** required at conditions 7, 8, 9, 21, 25, 26 and 32. It could also make use of public art, public events programs, oral histories, resources and/or references to the Marshall archaeological site (Victorian Heritage Inventory H7721-0119) and supplemental online interpretation.

35. The endorsed **Heritage Interpretation Plan** at condition 34 is to be implemented on site and made available to the public in other recommended means prior to the expiration of this permit, to the satisfaction of the Executive Director. This condition will be satisfied on receipt of written confirmation from the Executive Director.

36. Within 2 months of endorsement of the **Heritage Interpretation Plan** required at condition 34, a costed schedule for the implementation of the works described in this document is to be lodged and approved in writing by the Executive Director. An **unconditional Bank Guarantee** made out to the Heritage Council of Victoria (ABN 87 967 501 331) for the amount of the works identified in the approved costed schedule plus a 20% contingency amount, minus the amount provided at

condition 33. The bank guarantee is required to ensure satisfactory implementation of the Heritage Interpretation Plan required by this permit. The Bank Guarantee will be forfeited if the Heritage Interpretation Plan is not implemented to the satisfaction of the Executive Director. The Bank Guarantee will be returned together with the Bank Guarantee secured at condition 33 on the implementation of the Heritage Interpretation Plan (endorsed at condition 34) required to satisfy condition 35.

AT COMPLETION OF ALL WORKS

37. Prior to the expiration of the permit, the Executive Director must be informed of the completion of all works approved by this permit (including works required by the conditions of the permit) by submitting a **Final Project Report** to the satisfaction of the Executive Director. The Final Project Report must include the following:

a) A summary of how and when each of the conditions of the permit was satisfied;

b) Documentation of the changes which have occurred at the heritage place, including documentation of any significant material which has been removed, altered, revealed or excavated from the heritage place.

This condition will be satisfied on receipt of written confirmation from the Executive Director.

PREVENTION OF DAMAGE AND HISTORICAL ARCHAEOLOGICAL ARTEFACTS

38. Approved works or activities are to be planned and carried out in a manner which prevents damage to the registered heritage place/object. However, if other previously hidden original or inaccessible details of the object or heritage place are uncovered, any works that may affect such items must immediately cease. The Executive Director must be notified of the details immediately to enable Heritage Victoria representatives to inspect and record the items, and for discussion to take place on the possible retention of the items, or the issue of a modified approval.

39. All works must cease, and Heritage Victoria must be contacted if historical archaeological artefacts or deposits are discovered during any excavation or subsurface works.

NOTE THAT PERMISSION HAS BEEN GIVEN FOR INSPECTIONS OF THE PLACE OR OBJECT TO BE UNDERTAKEN DURING THE CARRYING OUT OF WORKS, AND WITHIN SIX (6) MONTHS OF NOTIFICATION OF THEIR COMPLETION.

TAKE NOTICE THAT ANY NATURAL PERSON WHO CARRIES OUT WORKS OR ACTIVITIES NOT IN ACCORDANCE WITH THE PERMIT OR CONDITIONS IS GUILTY OF AN OFFENCE AND LIABLE TO A PENALTY OF 120 PENALTY UNITS ($21,808.80 FROM 1 JULY 2021) OR IN THE CASE OF A BODY CORPORATE 600 PENALTY UNITS ($109,044 FROM 1 JULY 2021) UNDER s104 THE HERITAGE ACT 2017.

WORKS UNDERTAKEN WITHOUT A PERMIT OR PERMIT EXEMPTION CAN INCUR A FINE OF UP TO 4800 PENALTY UNITS ($872,352 FROM 1 JULY 2021) FOR A NATURAL PERSON OR 5 YEARS IMPRISONMENT OR BOTH AND UP TO 9600 PENALTY UNITS ($1,744,704 FROM 1 JULY 2021) IN THE CASE OF A BODY CORPORATE UNDER SECTION 87 OF THE HERITAGE ACT 2017.

THE ATTENTION OF THE OWNER AND/OR APPLICANT IS DRAWN TO THE NEED TO OBTAIN ALL OTHER RELEVANT PERMITS PRIOR TO THE COMMENCEMENT OF WORKS.

Date Issued:

16 November 2020

Signed as delegate for the Executive Director, Heritage Victoria pursuant to the Instrument of Delegation

HERITAGE VICTORIA

Amendment Issued:

21 October 2024

Nicola Stairmand
Manager, Statutory Approvals
Heritage Victoria

Date of amendment	Brief description of amendment
02 March 2022	
20 January 2023	**Extension of time allowed to complete condition 16 (entering into a Covenant) from 6 months to 18 months. The Covenant is due to be entered into by 1 February 2024.**
21 October 2024	Extension of time to the period of validity of the permit. The permit now expires on 16 November 2028. Extension of time allowed to complete conditions 13 and 16 (entering into a Covenant) to 4 years. The Covenant is due to be entered into by 1 August 2026.