ASPECT Studios

Kleins Road Pedestrian and Cyclist Corridor

Corridor Study and Concept Design

Working Paper B – Bridge Feasibility Study

May 2024

Question today

Imagine tomorrow

Create for the future

Kleins Road Pedestrian and Cyclist Corridor

Corridor Study and Concept Design

Working Paper B – Bridge Feasibility Study

City of Parramatta

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1.1	27 February 2024	Draft
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	Name	Date	Signature
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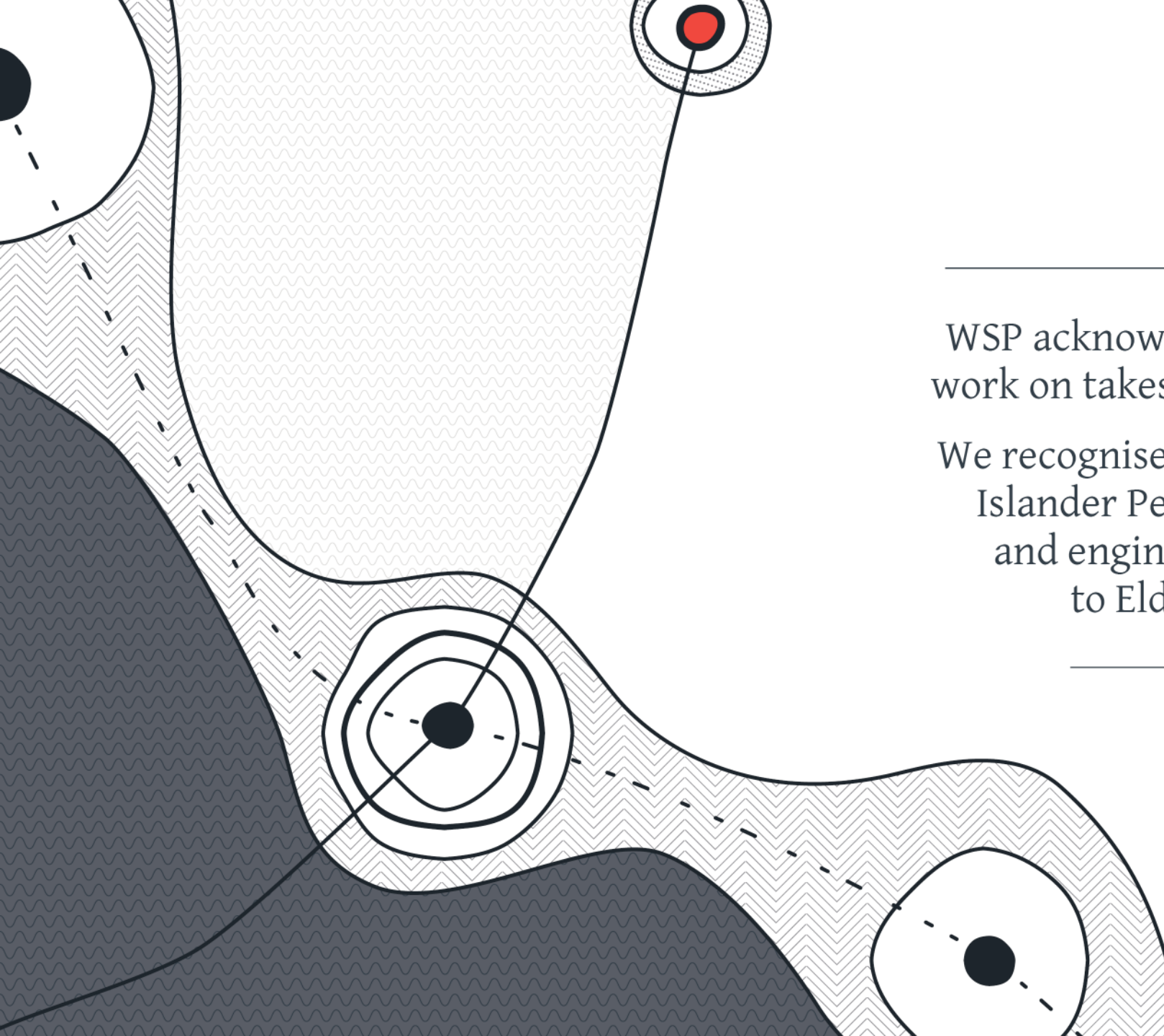
Review by:	Gareth Mills	28 May 2024	
Approved by:	Gareth Mills	28 May 2024	



WSP acknowledges that every project we work on takes place on First Peoples lands.

We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

NGALAYA / FRIEND AND ALLY *Dharug*

Artwork co-designed by:
Michael Hromek, *Budawang*
Technical Executive – Indigenous (Architecture), Design and Knowledge, WSP and
Sandra Palmer, Creative Director, WSP

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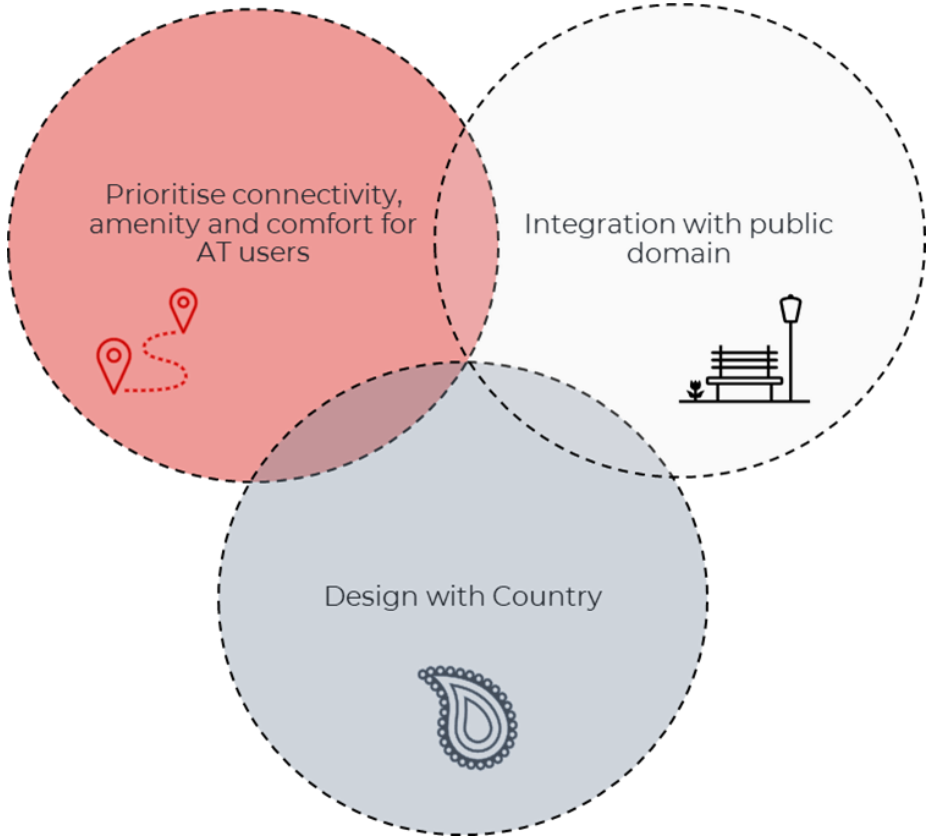


1. Introduction

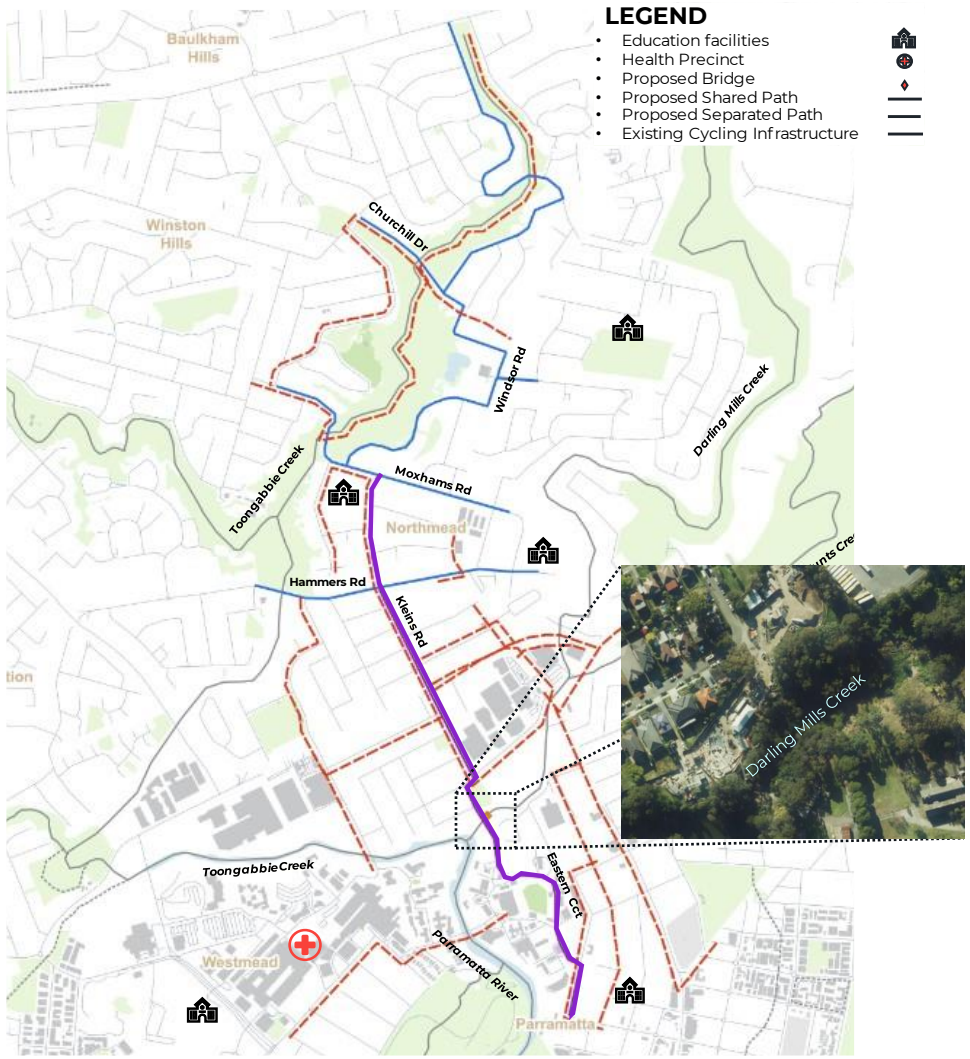
Project overview

The **Kleins Road Pedestrian and Cyclist Corridor** is a Get NSW Active funded project to provide an integrated transport planning review of the proposed route and a new bridge crossing Darling Mills Creek.

As part of the first stage of the process, **Working Paper B** (this document) will provide an assessment of the feasibility and form of the proposed crossing of Darling Mills Creek. This crossing represents the most significant infrastructure requirement of the project.

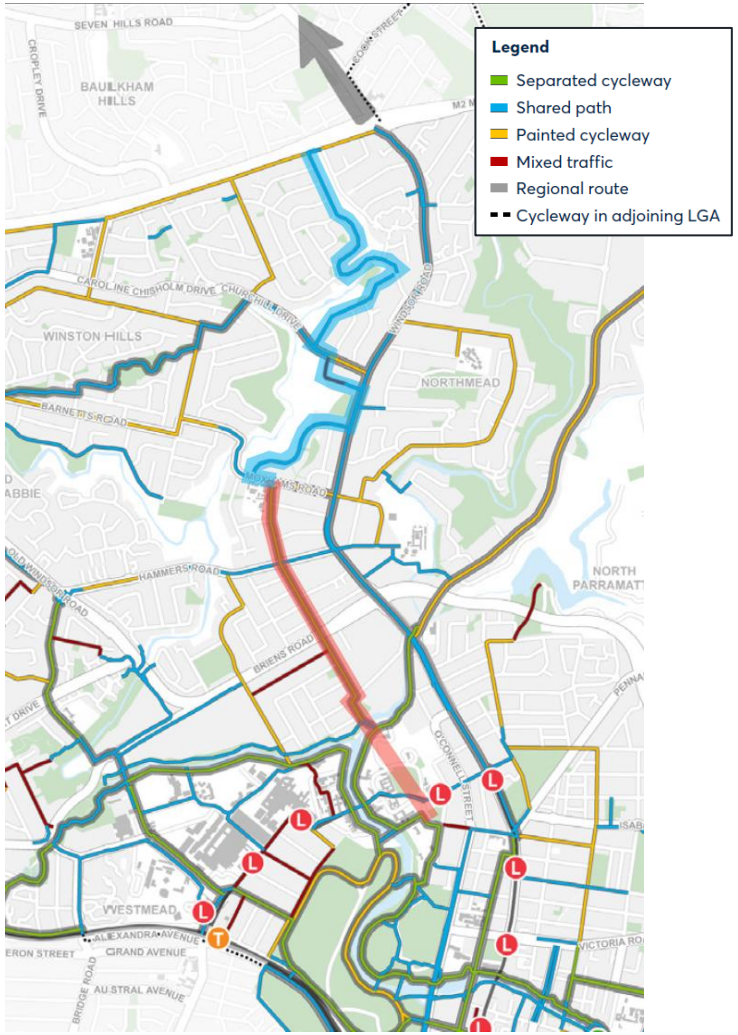
With this document, an overview of the natural and urban environment is provided together with initial design principles relating to country. Following this, possible bridge form type and structure are outlined with their respective pros and cons in relation to crossing the creek.

The accompanying **Working Paper A** provides a review of the alignment of the project including proposed kerbside locations and appropriate provisions for cyclists and pedestrians both on and to the Kleins Road corridor.



Project needs

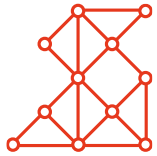
1. **Deliver a key component of the City's Parramatta Bike Plan 2023** – Improving cycling connection to Northmead, Winston Hills and onward to Baulkham Hills.
2. **Improve walking and cycling connections to across Darling Mills Creek** – Provide an attractive alternative for users across Darling Mills Creek for commuting and recreation.
3. **Supporting access to the Parramatta North Urban Transformation and Westmead Hospital Precinct** - Together with PLR Active Transport Link, provide improved access to PNUT and Westmead.
4. **Create a new link to promote the Dharug people's Connection with Country** – Acknowledge and promote the importance of the corridor and Darling Mills Creek to the people of the Dharug nation through design and knowledge sharing



Proposed Kleins Road separated Corridor (shown in red) and shared path (shown in blue) as part of the Draft Parramatta Bike Plan 2023

Project objectives

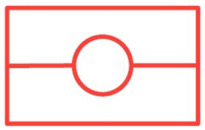
Identify the **preferred kerbside alignment** for the separated cycleway along Kleins Road



Confirm **routes and arrangement of shared paths** to connect to the Kleins Road Cycleway

Identify opportunities for **streetscape improvements** as part of design process

Undertake engineering and design evaluation of proposed Darling Mills Creek bridge which is functional, deliverable and in keeping with local area



Provide opportunity through design and knowledge sharing to demonstrate the connection of Dharug people to the land on which the project is sited.

2. Analysis

Walk on Country

A Walk on Country was held with First Nations Knowledge Holders on the 23rd October 2023 to gain their initial thoughts about the Kleins Road Cycling Corridor Study.

The land on which the project sits is that of the Burramattagal of the Darug language group who are the traditional custodians of the site.

At the Walk on Country, members of the project team and the Darag Panel Knowledge Holders visited the creek and its surrounds to understand more about its stories, themes, history and nature. The information gained will be used to inform the design process not just for the bridge, but across the entire study corridor.

In the following pages, pictures taken from the walk are shown together with an overview of its relevance to country. This should be read in conjunction with the accompanying **Aboriginal Design Principles** document for the project.

Walk on Country

Walk on Country

Walk on Country

Walk on Country

Walk on Country

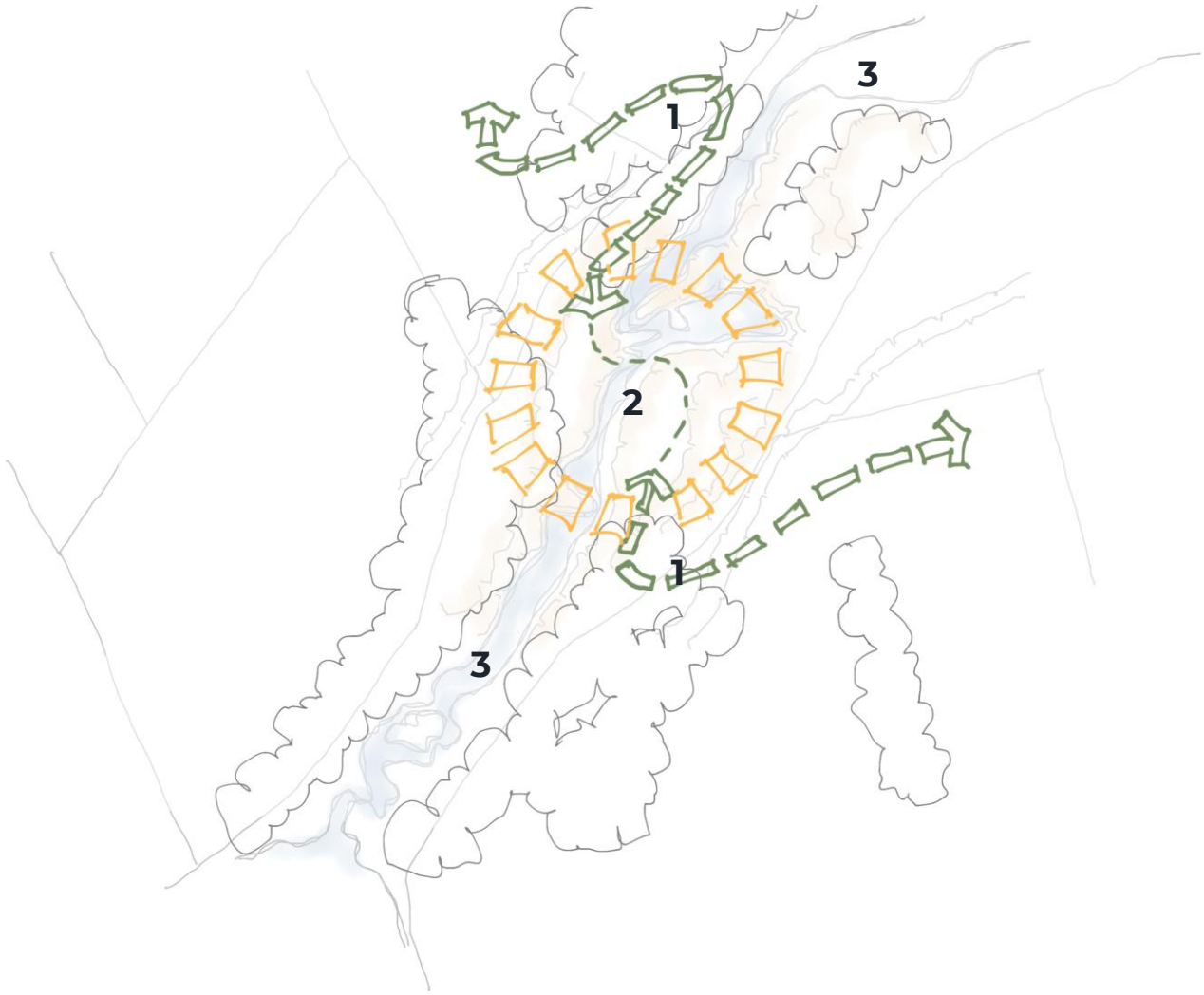
Walk on Country

Walk on Country

Walk on Country

Country

1. Potential Song Line (Green arrows) – access down the banks of the creek to a crossing point
2. A known gathering space around the rock platforms and crossing points of the creek.
3. Relatively intact natural creek with regrowth of trees and overgrown with weeds and rubbish

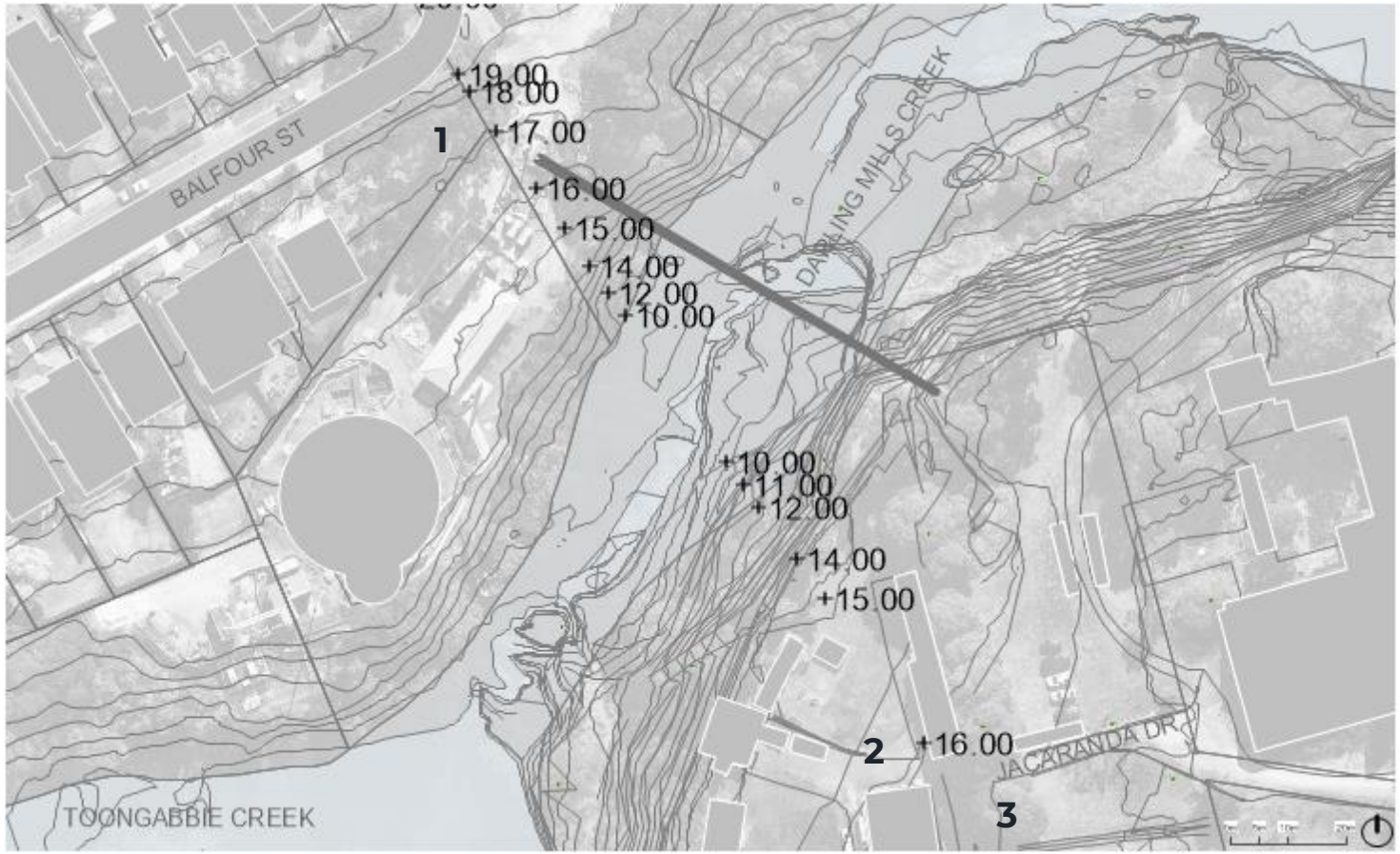


Topography

Like most natural creeks, the depth and topography of Darling Mills Creek varies.

For illustration, at the approximate crossing span of the bridge the height ranges from a peak of 19m Australian Height Datum (AHD) on its northern side to a depth of 10m AHD.

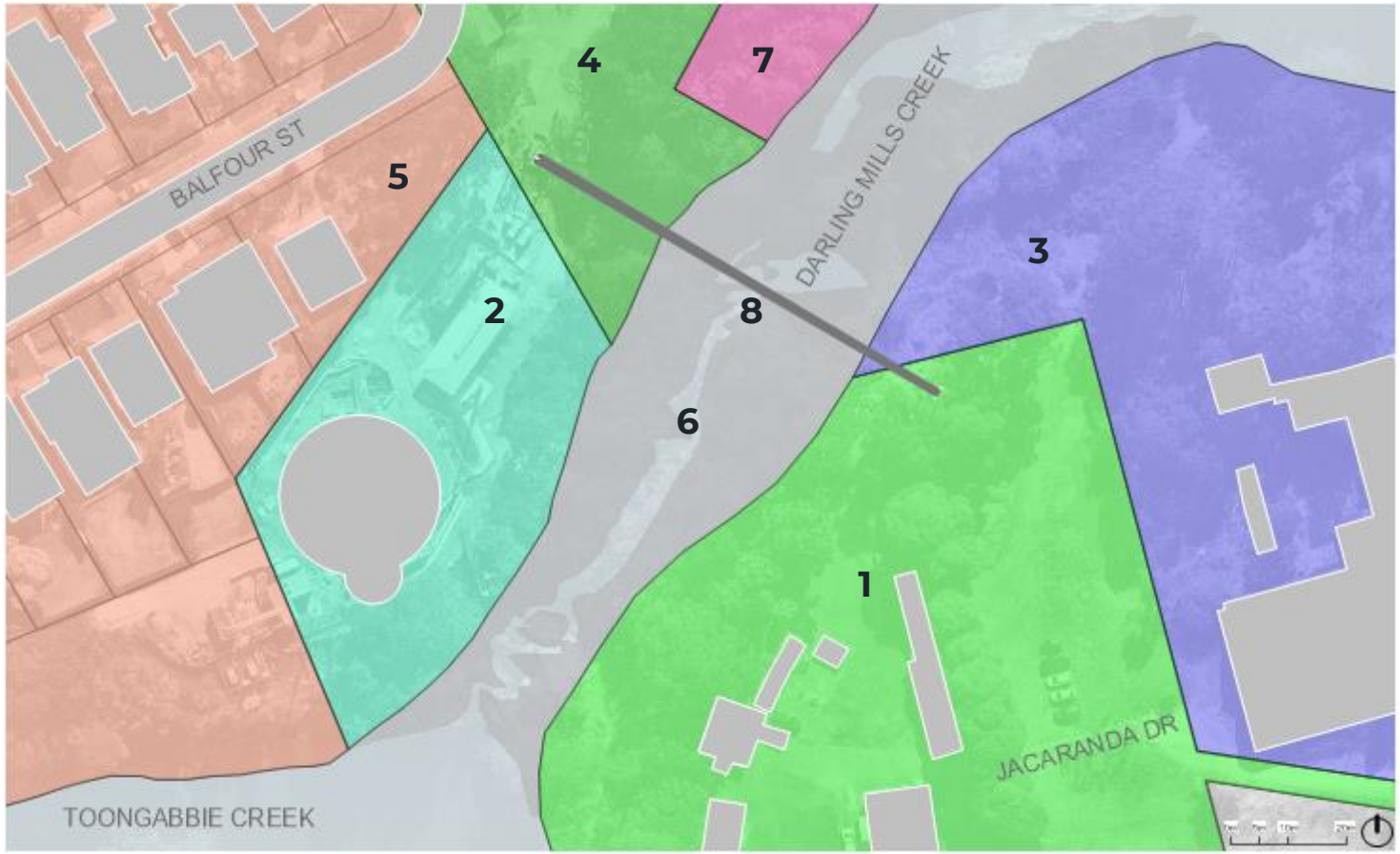
1. Northern embankment about 18m AHD
2. Southern embankment about 16m AHD
3. Jacaranda Drive about 17m AHD



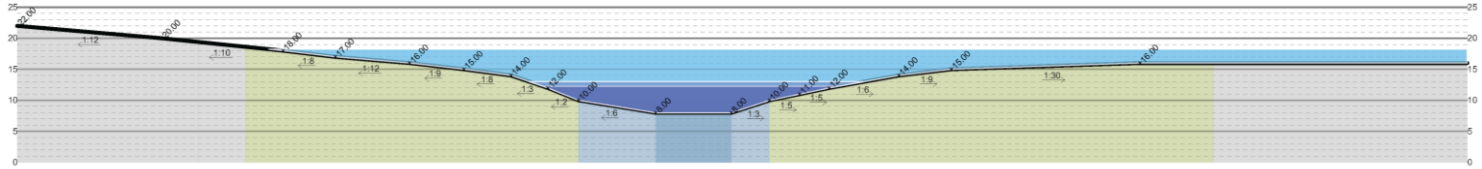
Land Ownership

Several public and private landowners are present within the study area.

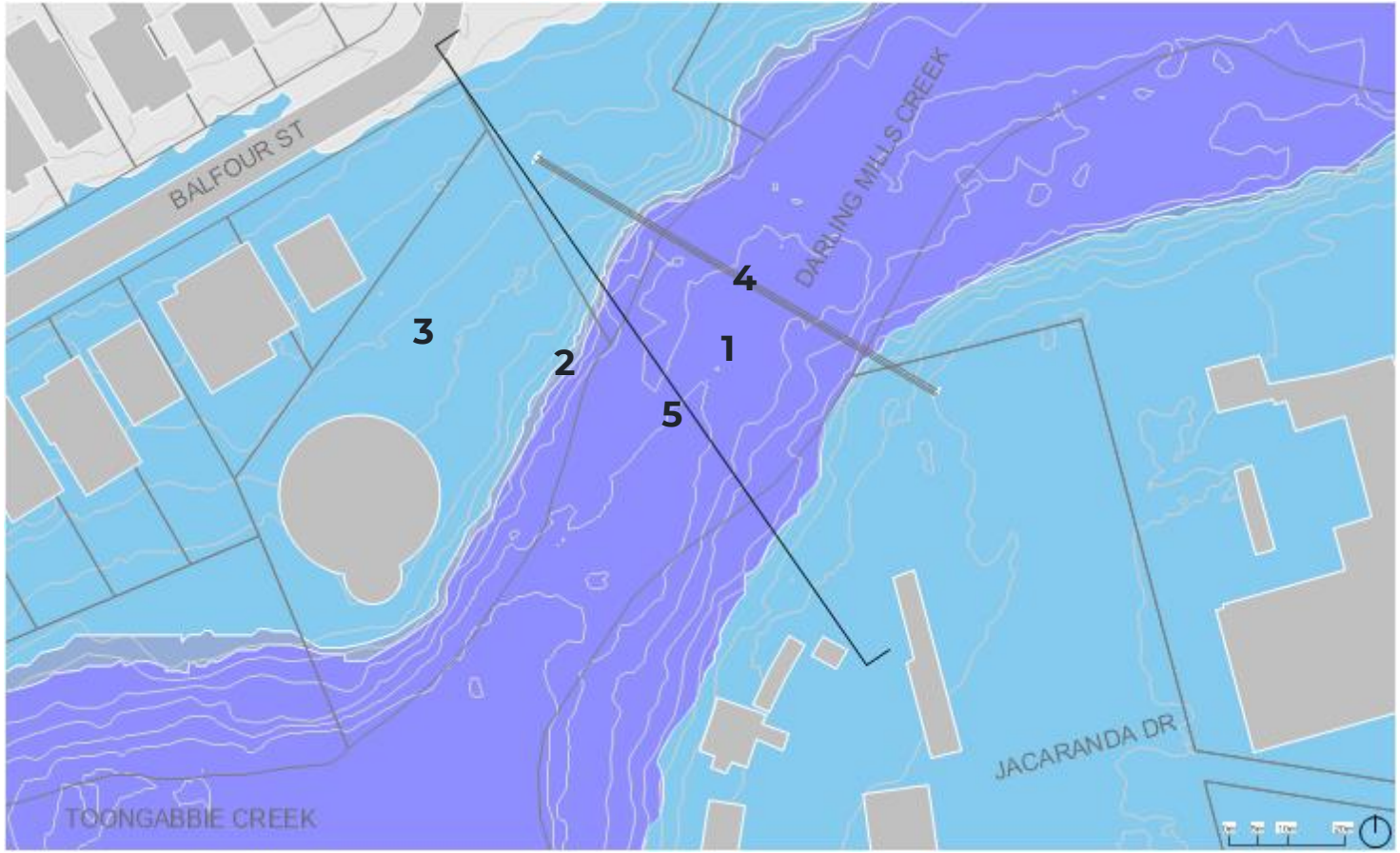
1. Property & Development NSW
2. Sydney Water
3. Deerubbin land
4. Public Park – City of Parramatta Council
5. Low density residential – private ownership
6. Crown land TBC
7. General industrial – private ownership
8. Existing power lines



Flooding



1. 20 year ARI flood
   RL +11.26
2. 100 year ARI flood
   RL +11.65
3. PMF
   RL +17.54
4. Existing powerlines
5. Approximate bridge alignment

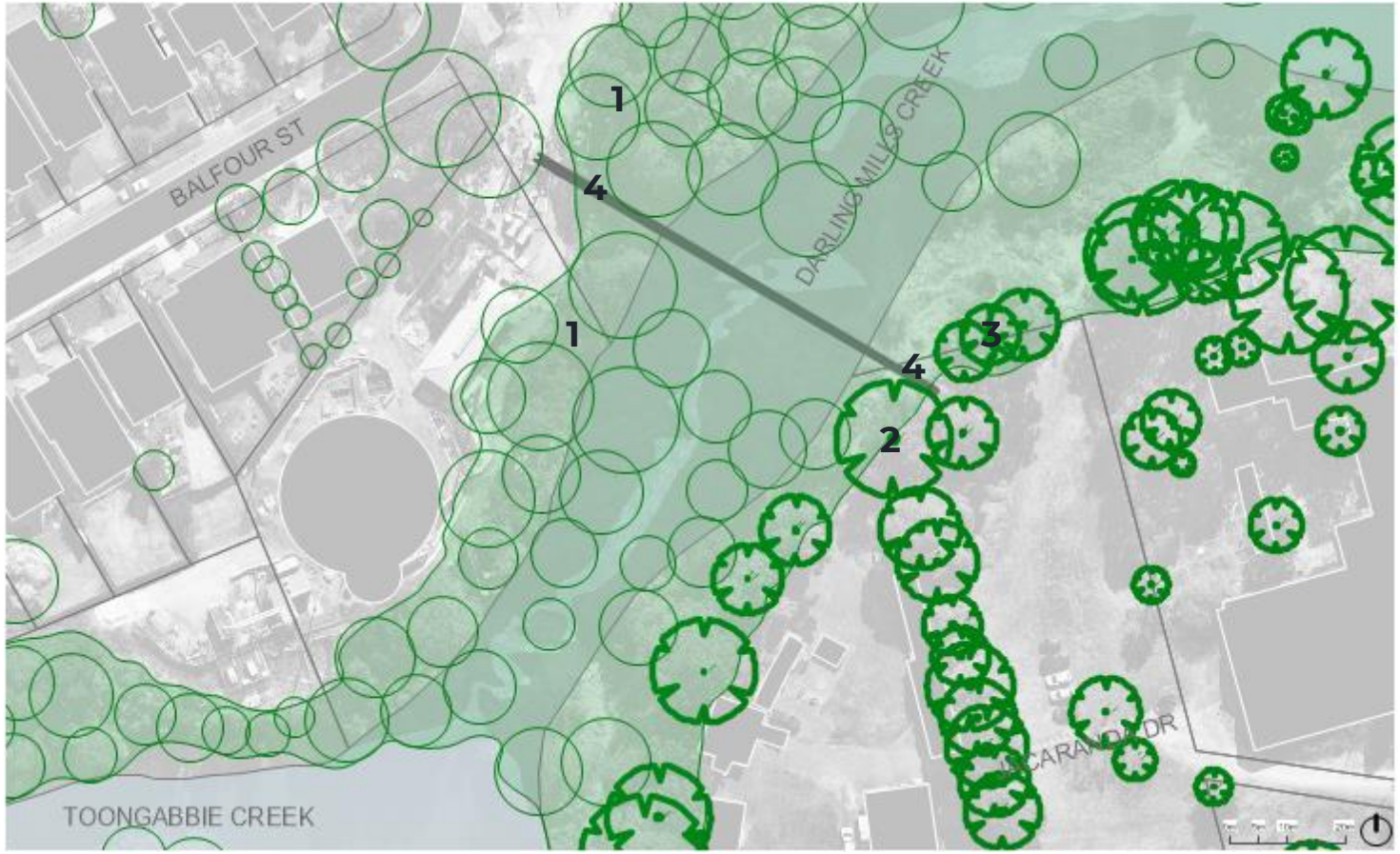


ARI = Average Recurrence Interval - long-term average number of years between floods of a certain magnitude

PMF = Probable Maximum Flood - The PMF defines the extent of flood prone land or flood liable land, that is, the floodplain.

Vegetation

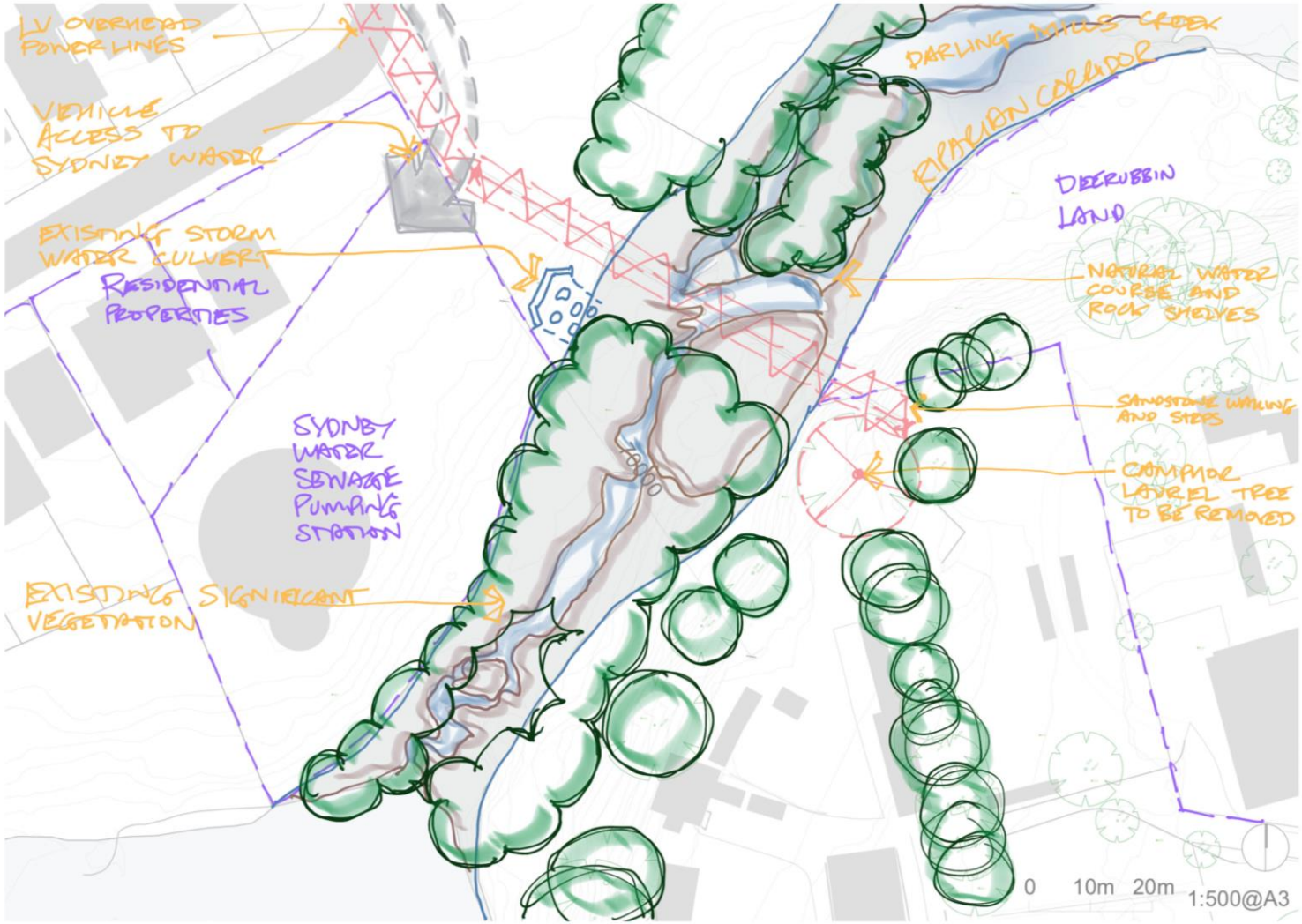
1. Existing vegetation on northern embankment
2. Camphor laurel suitable for removal
3. 3 no. Eucalypts preferred to be retained
4. Some vegetation cleared around the power line easement



3. Issues and Opportunities

Bridge Alignment Constraints

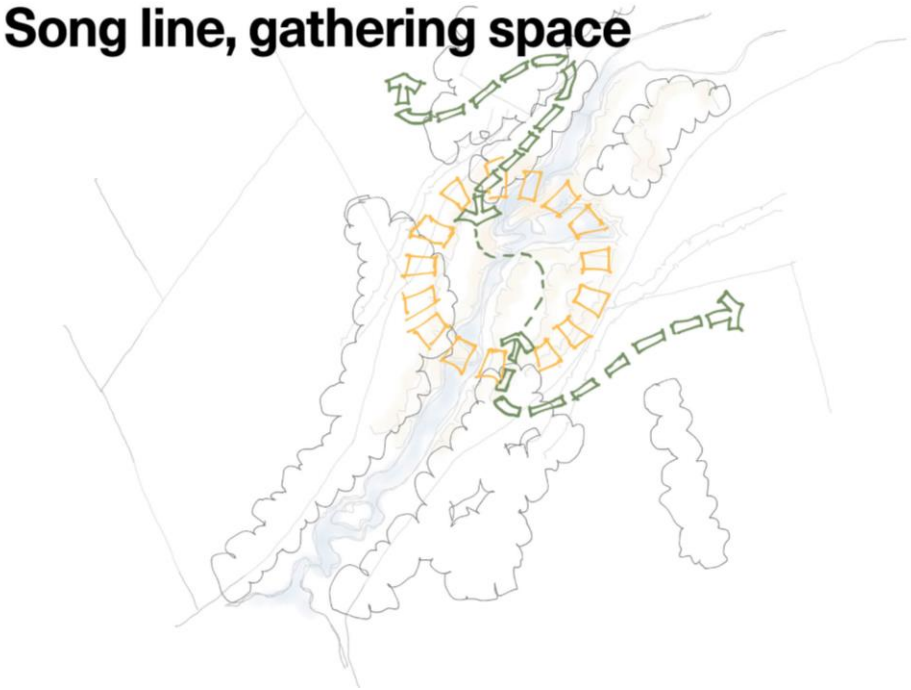
1. Existing vegetation
2. LV Overhead Powerlines
3. Riparian Corridor, natural water course and rock shelves
4. Storm water culvert
5. Land ownership
6. Vehicle access to Sydney Water

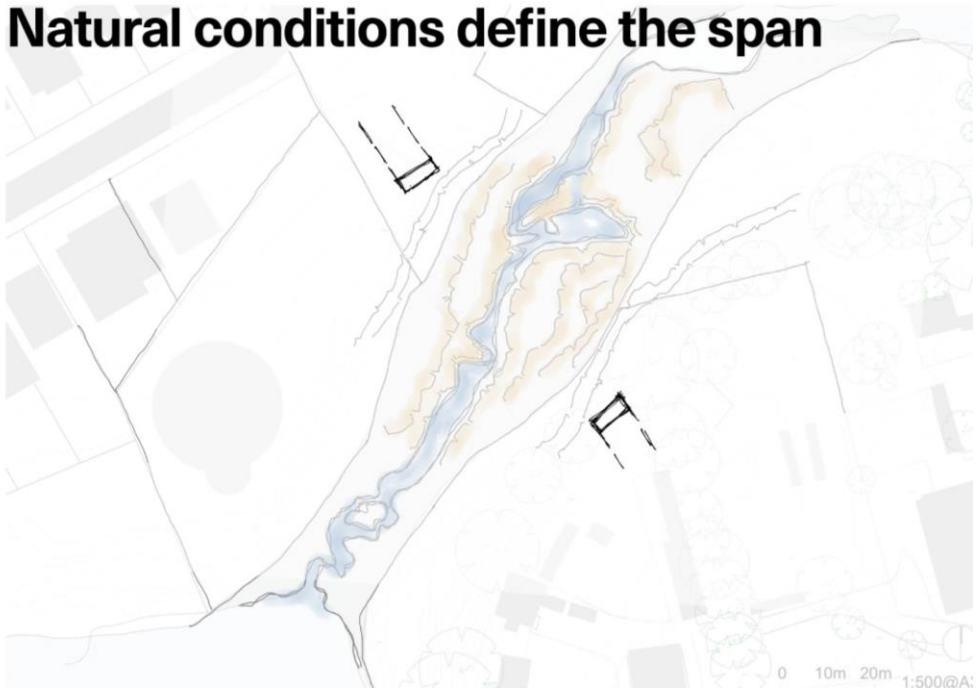


4. Preliminary Bridge Options

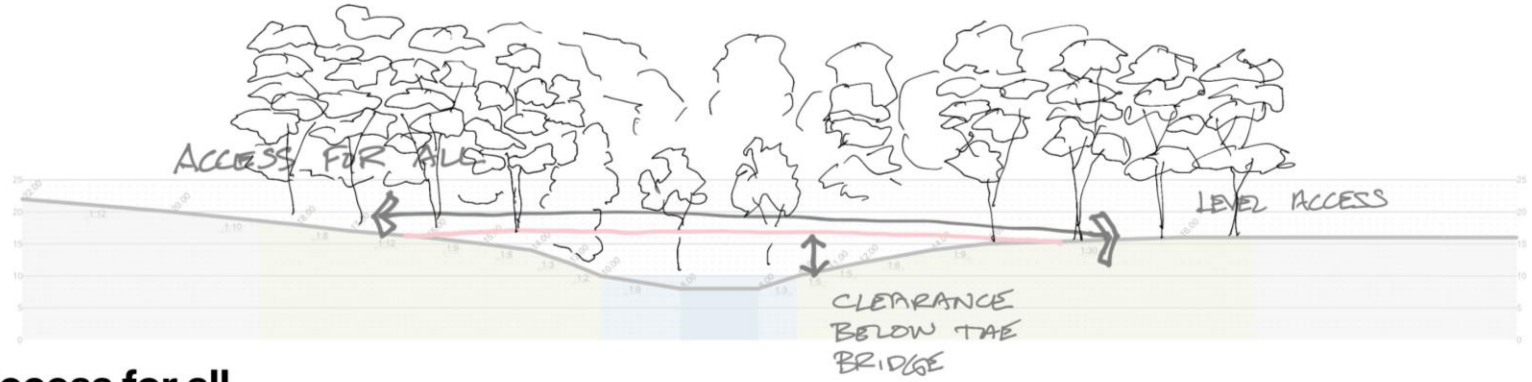
Bridge Design Principles

Respect Country -

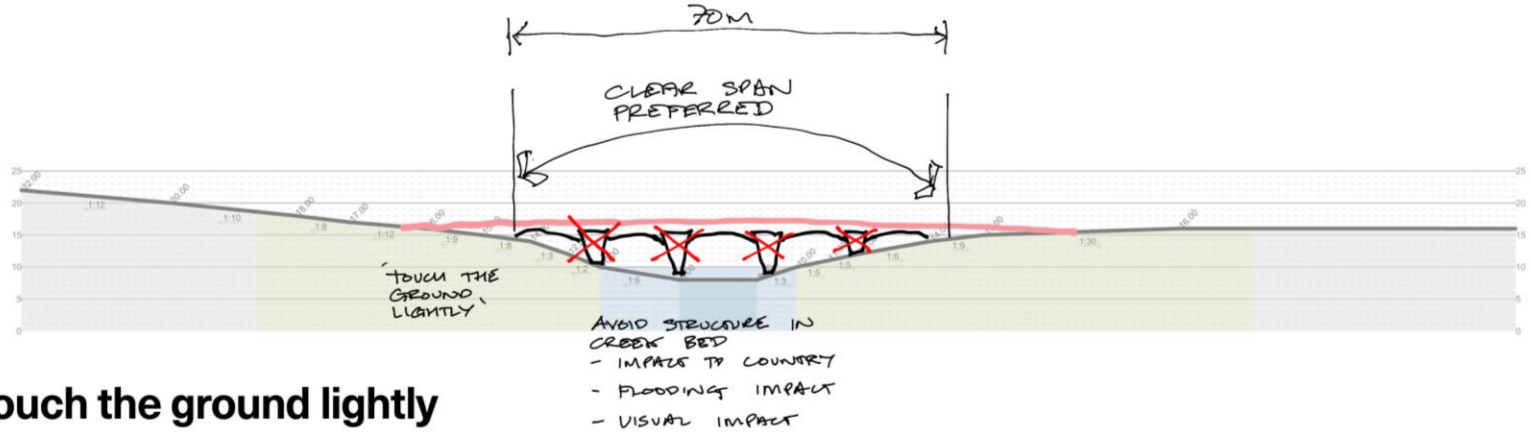




Bridge Design Principles

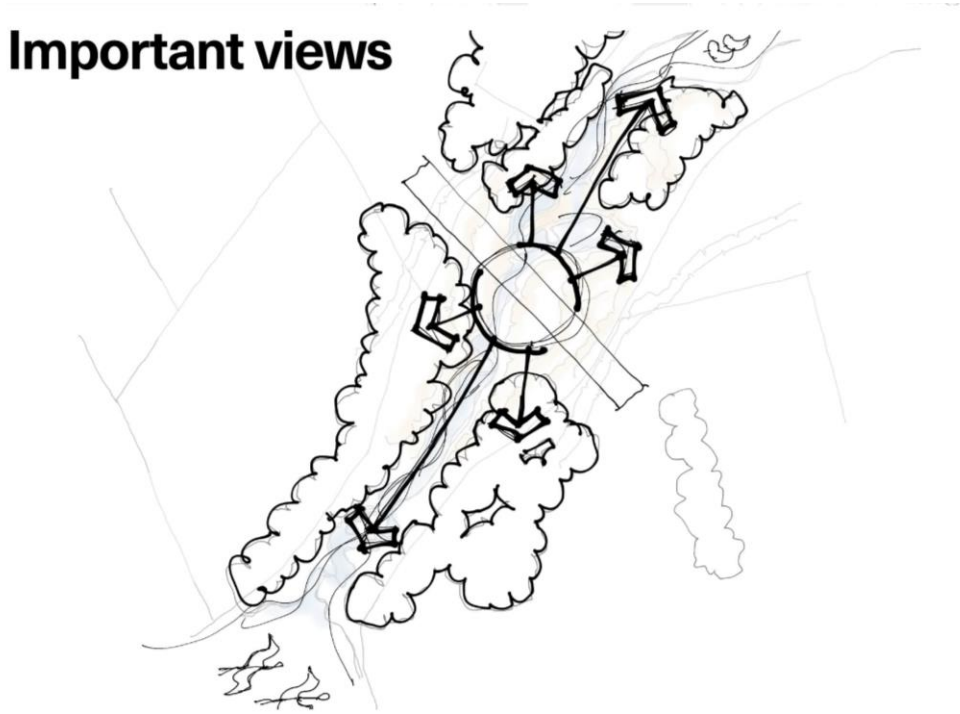


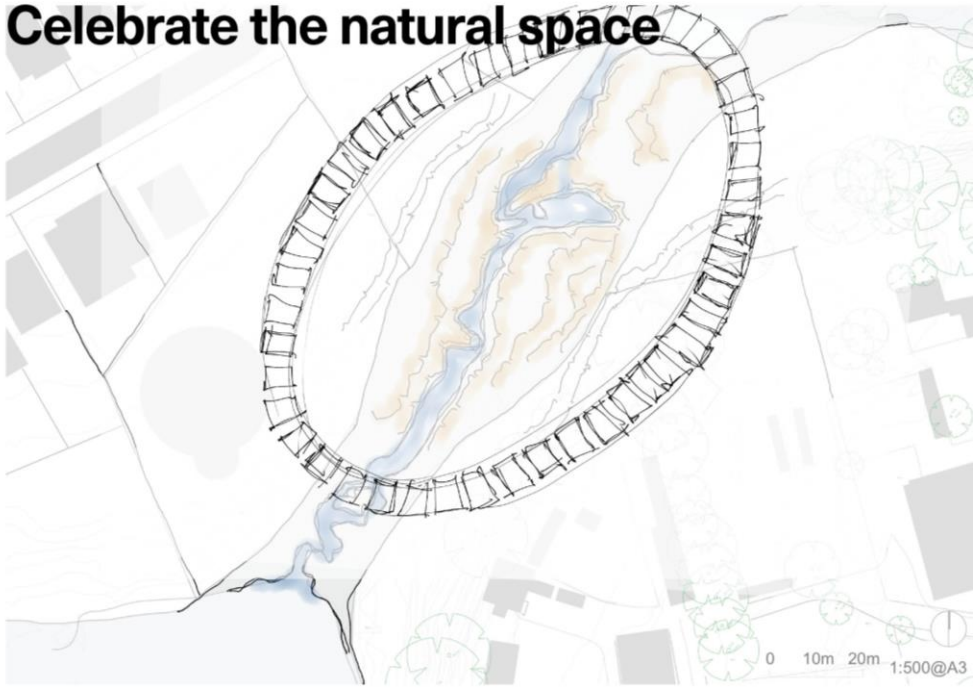
Access for all



Touch the ground lightly

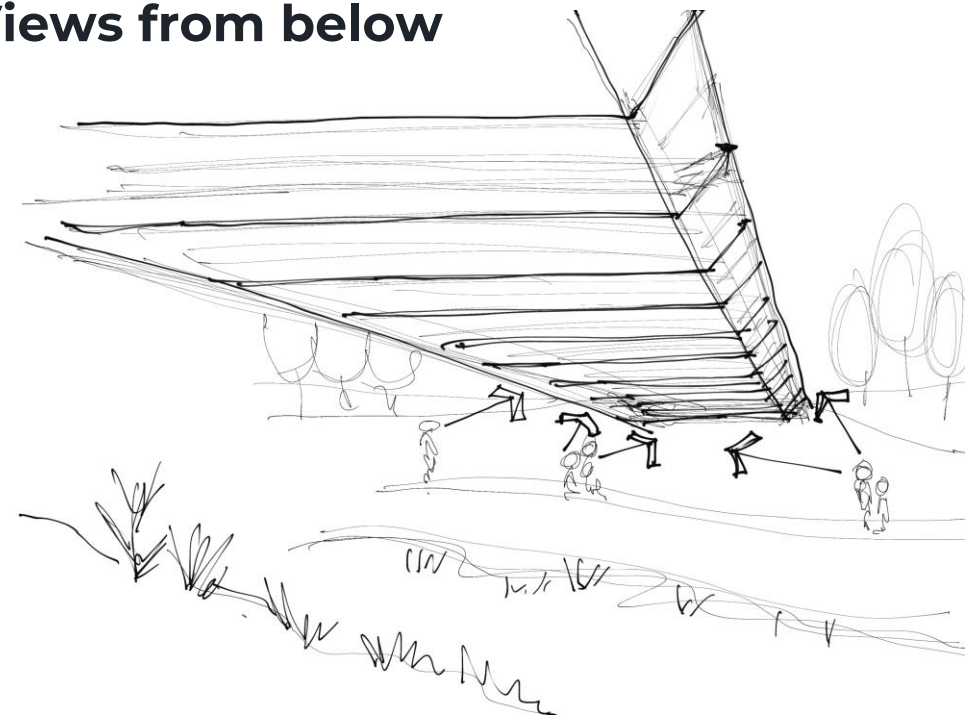
Bridge Design Principles



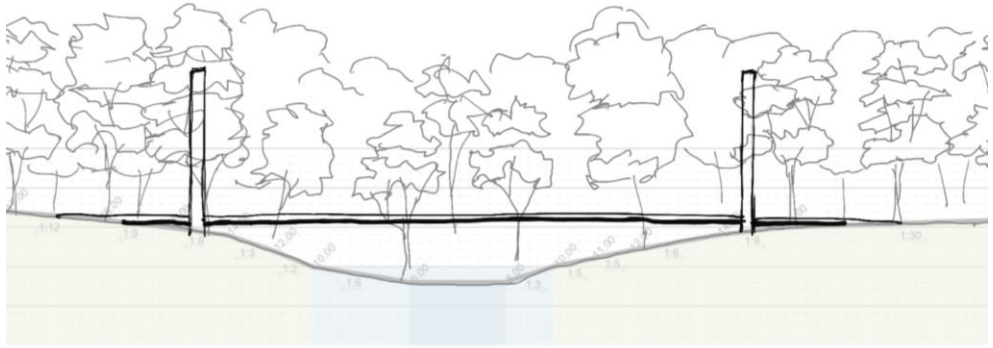


Bridge Design Principles

Views from below



Recessive against the natural context



Alignment Options 1 & 2

Option 1

Avoids land ownership issue, aligns to proposed road in the Parramatta North Urban Design Framework. Impacts more existing vegetation than Option 2.

Option 2

Follows the power line easement limiting impacts to existing vegetation.

Landownership issues.

Alignment option 1

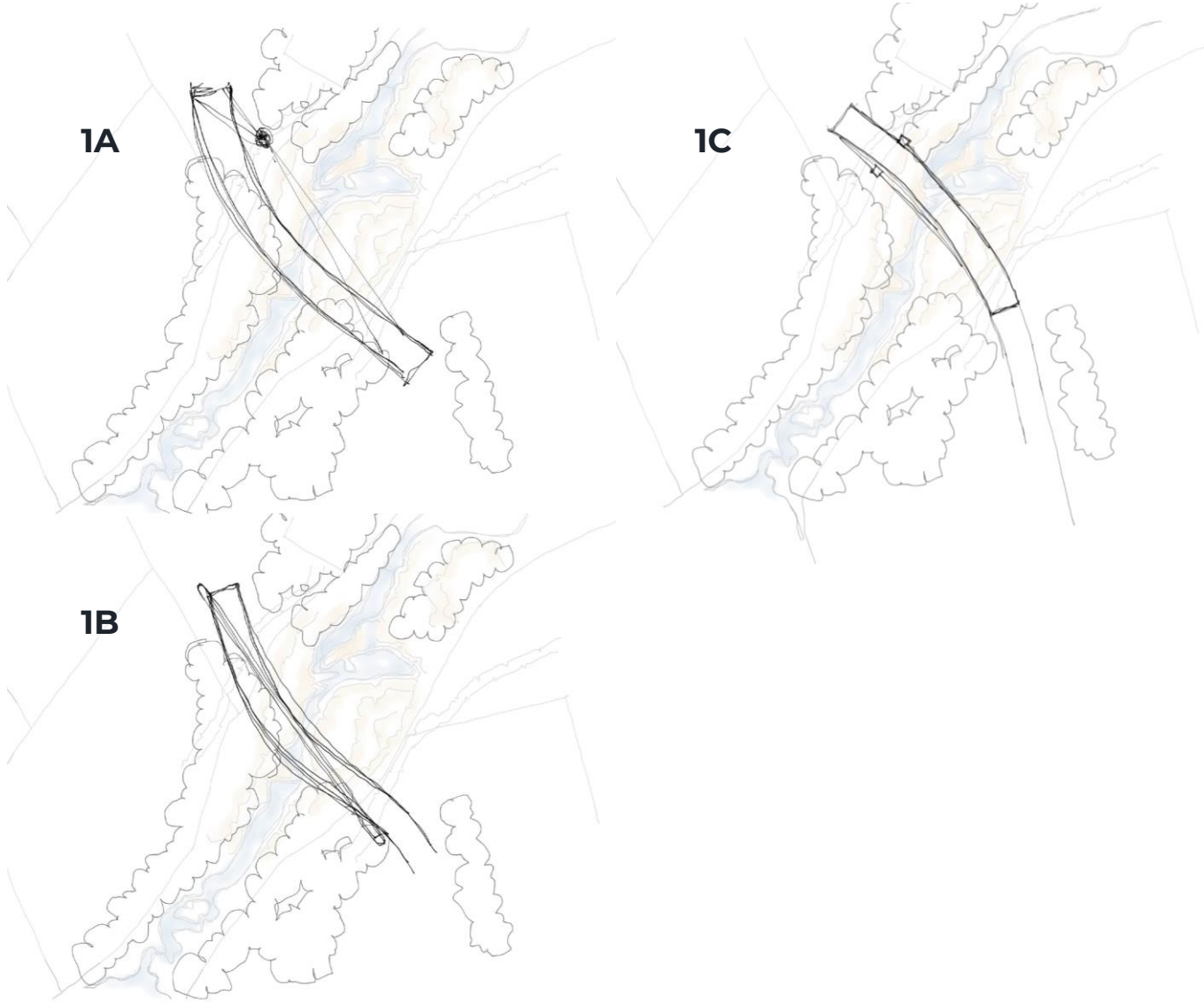
Aligning the southern landing with the future road alignment of the Parramatta North Urban Design Framework

Alignment Variations - Curved

Option 1B, C & D

Study sketches into curved alignments that open up improved views over the creek and potentially visually more integrated to the natural context.

Structurally more complex. Only possible with some bridge types.



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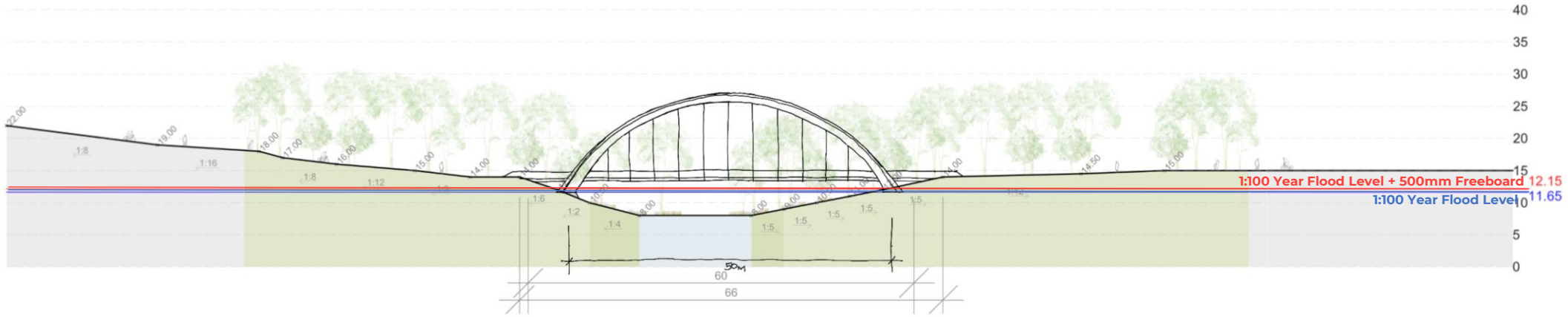
Arch Bridge Option – Sketch Elevation



Arch Bridge Option

Precedents

Alfred Street Bridge, Parramatta

- Arch
- 170m total length
- 80m main span
- 4.5m width

Arch Bridge Option

Precedents

Hofstraat Bridge, Landgraaf, Netherlands

- Arch (engineered timber)
- 60m total length
- 35m main span
- 4m width

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Arch Bridge Option

Precedents

Tukwila Bridge, Seattle, USA

- Arch
- 120m total length
- 70m main span
- 4.5m width

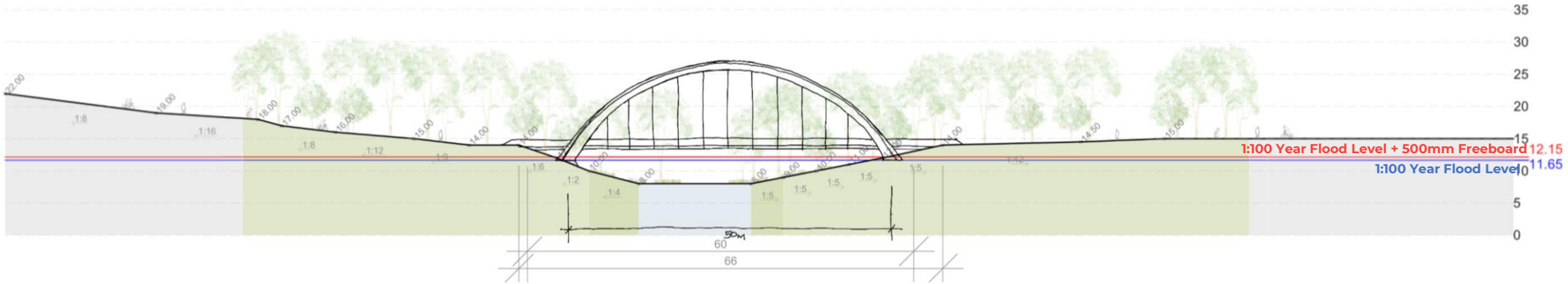
Comments

Pros

- Arch provides superstructure above the deck providing a clear span over the creek.
- Enables a minimal deck depth
- Greater visual transparency for people on the bridge viewing the adjacent landscape
- Allows clear views and access below the bridge

Cons

- The architectural form of an arch option introduces an overstated element within the sensitive site setting.



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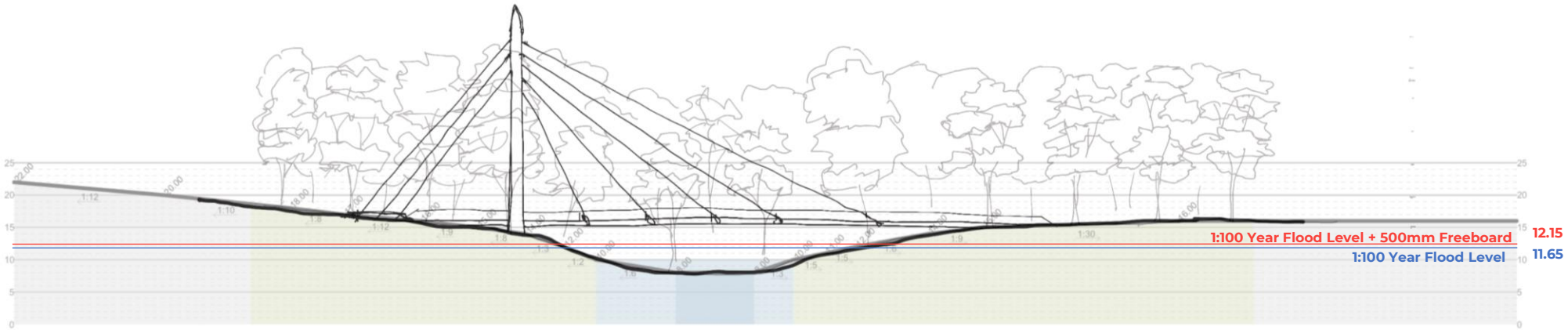
Cable Stay Bridge Option – Sketch Elevation



Cable Stayed Bridge Option

Precedents

Water of Leith bridge, Dunedin

- Cable stayed
- 70m total length
- 45m main span
- 3.5m width
- 22m mast height

Cable Stayed Bridge Option

Precedents

Pomeroy Street M4 Bridge, Sydney

- Cable stayed
- 60m main span
- 3m width

Cable Stayed Bridge Option

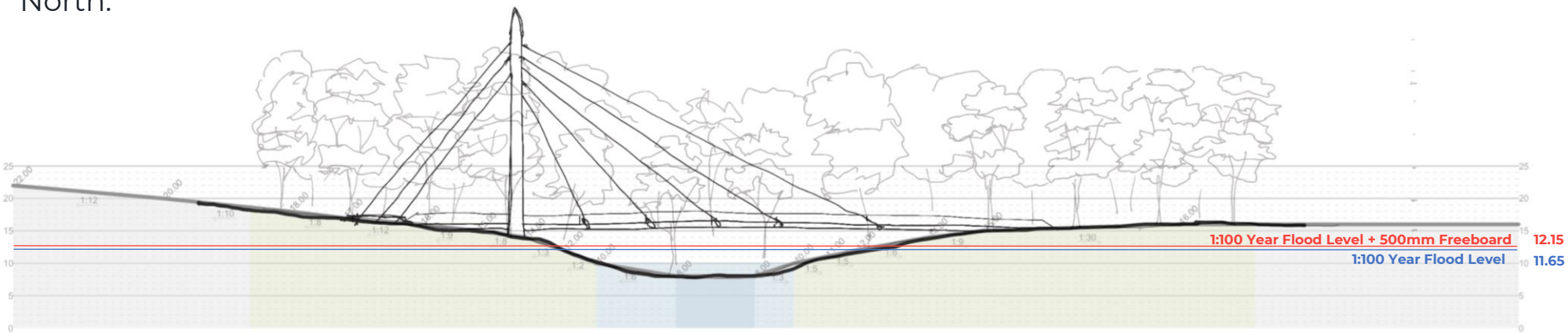
Comments

Pros

- Cable Stay provides superstructure above the deck providing a clear span over the creek.
- Enables a minimal deck depth
- Visual transparency for people on the bridge viewing the adjacent landscape
- Mast / Pylon structure offset to creek
- Provides opportunity for single mast on northern side of creek to reduce impacts on Parramatta North.

Cons

- Single mast on northern side of creek is tall and could be visually dominant
- Requires space for back stays



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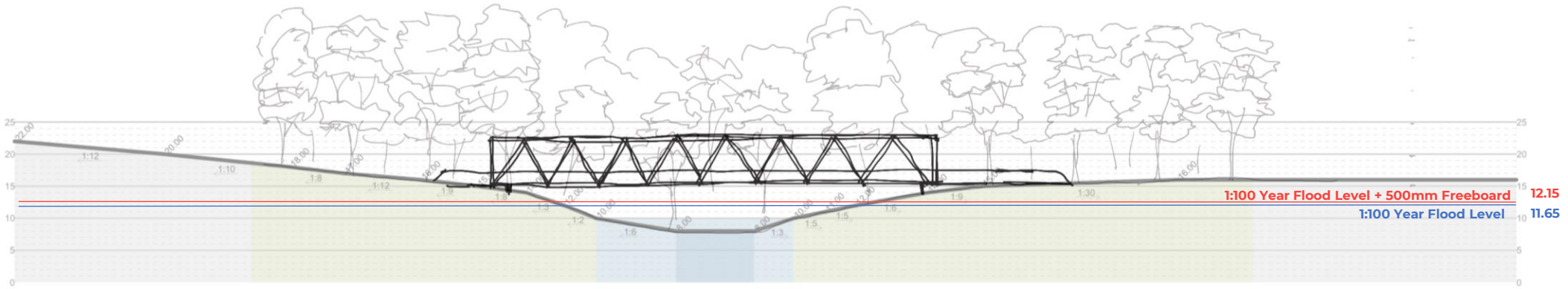
Truss Bridge Option

– Sketch Elevation



Truss Bridge Option

Precedents

Yandhai Nepean Crossing, Penrith

- Truss
- 380m total length
- 200m main span
- 5m width

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Truss Bridge Option

Precedents

Limmatsteg Bridge, Zurich

- Truss
- 50m main span
- 4m width

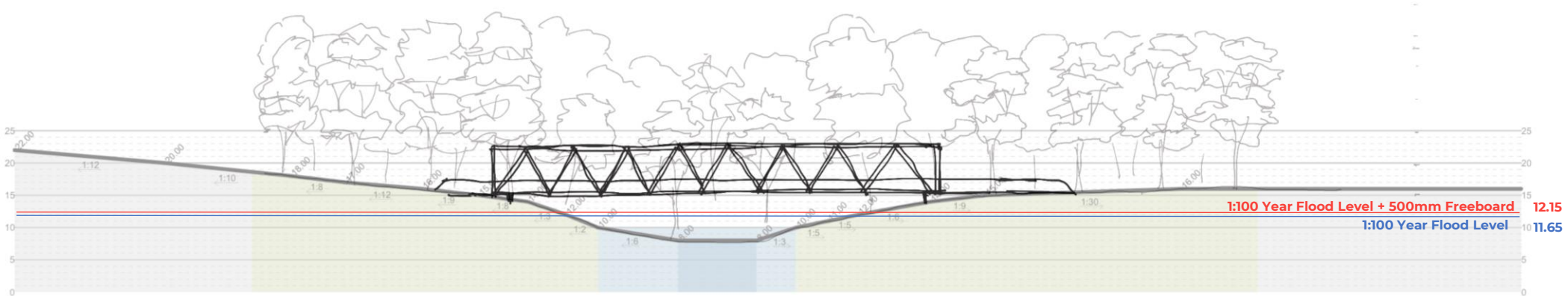
Comments

Pros

- Truss provides superstructure above the deck providing a clear span over the creek.
- Enables a minimal deck depth
- Allows clear views and access below the bridge
- Can have a curved alignment

Cons

- The architectural form of a truss option introduces an overstated element within the sensitive site setting.
- Truss structure impacts views over the creek.



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Suspension Bridge with Back Stay Option

– Sketch Elevation

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Suspension Bridge without Back Stay Option

– Sketch Elevation

Precedents

Marien bridge, Austria

- Suspension
- 150m main span
- 3.5m width

Precedents

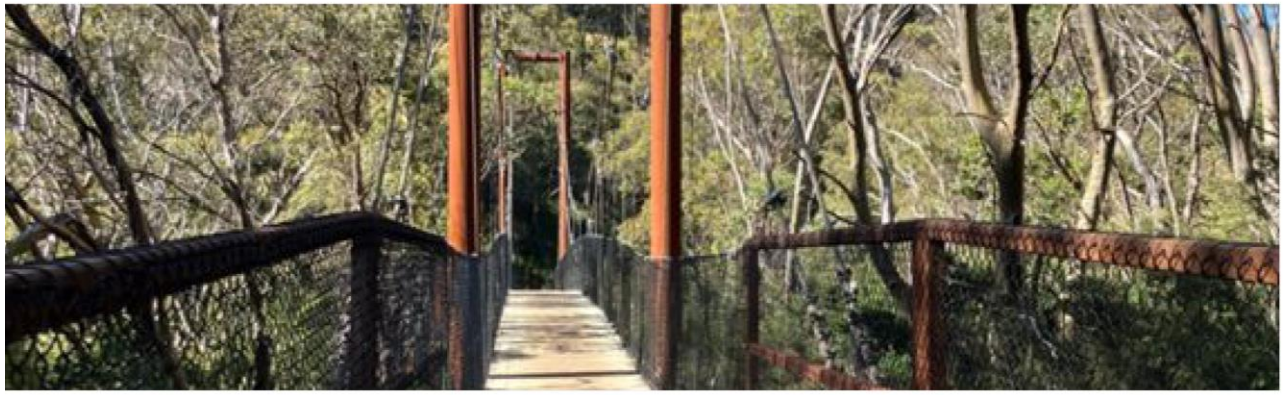
YBBS bridge, Austria

- Suspension
- 90m main span
- 3.5m width

Precedents

Thredbo Valley Bridge, Thredbo

- Suspension
- 50m main span
- 2.5m width



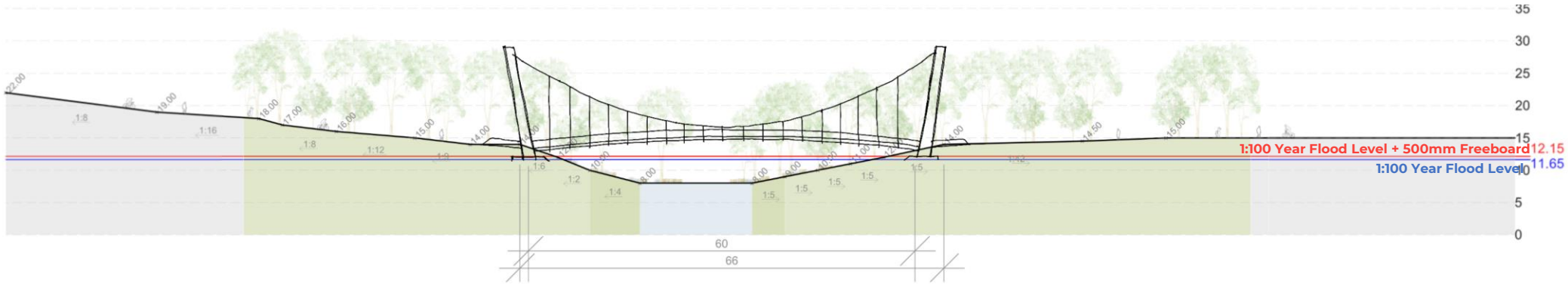
Comments

Pros

- Suspension provides superstructure above the deck providing a clear span over the creek.
- Enables a minimal deck depth
- Visual transparency for people on the bridge viewing the adjacent landscape
- Masts / Pylons structure offset to creek banks and form gates to the bridge
- Provides opportunity for single mast on northern side of creek to reduce impacts on Parramatta North.

Cons

- Movement may be experienced on the deck.
- Depending on structural solution may require space for back stays



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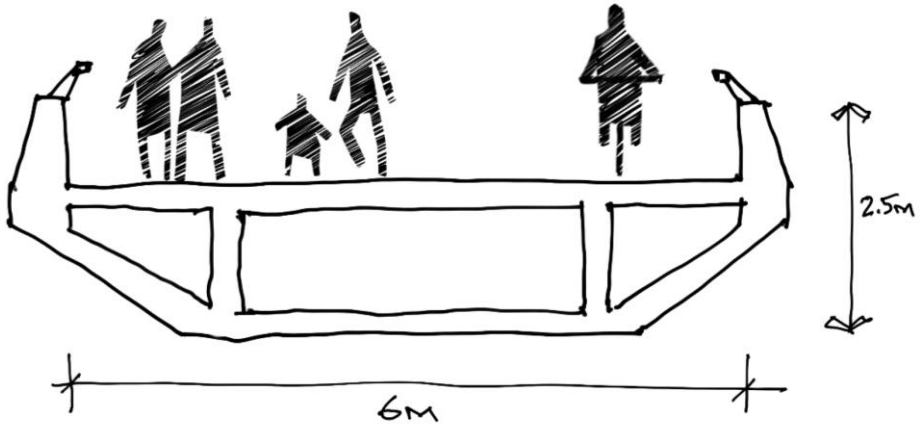
Box Girder Bridge Option

– Sketch Elevation



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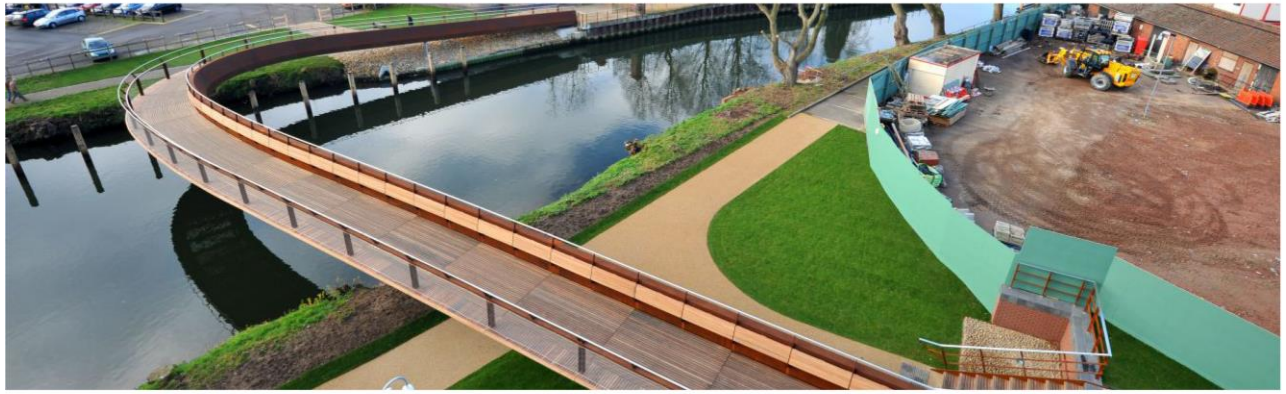
Steel Girder Option

Precedents

Jarrold Bridge, Norwich

- Steel girder
- 40m main span
- 3m width



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Concrete Girder Option

Precedents

Anzac Parade Pedestrian Bridge, Sydney

- Concrete girder
- 40m main span
- 4m width

Steel Girder Option

Precedents

Falcon Street Bridge, Sydney

- Steel girder
- 50m main span
- 3.5m width

Concrete Girder Option

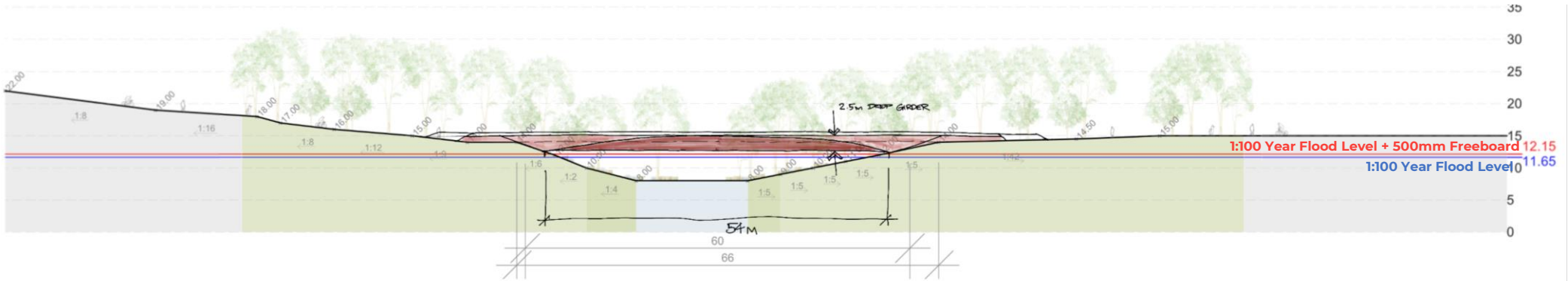
Comments

Pros

- Minimal above-deck superstructure
- Relatively simple form of bridge construction.
- Can have a curved alignment

Cons

- Deep deck impacting views and access below the bridge. Not sympathetic to the context
- Potential flood impacts
- Large abutments on the banks of the creek
- May require piers in the creek edges to achieve the span required.



Bridge Options Recommendations

Option No.	Description	Recommendation	Summary Comment
1	Arch	**Recommended**	A large arch subject to detailed design could potentially be an inappropriate architectural form for the site setting. Considering a through arch over a smaller span as a more appropriate form for the context.
2	Cable Stayed	**Not recommended**	Maximises views over the creek, minimal visual impact. A larger visual impact for users on the bridge with thicker diagonal cables. Large single mast. However the suspension option is a similar bridge form being considered.
3	Truss	**Not recommended**	Visual impact to setting, a closed structure and truss structure impacts views from the bridge.
4	Box Girder	**Recommended**	Deep structure, potential visual impact. If carefully designed a through structure could be supported as an option.
5	Suspension	**Recommended**	Maximises views over the creek, minimal visual impact. Symmetrical arrangement that locates masts and most of the cables against the adjacent vegetation on each side of the creek.

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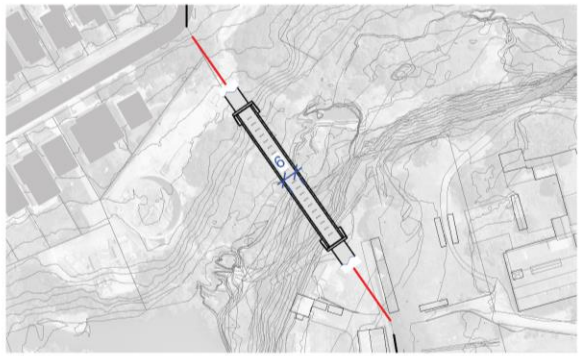
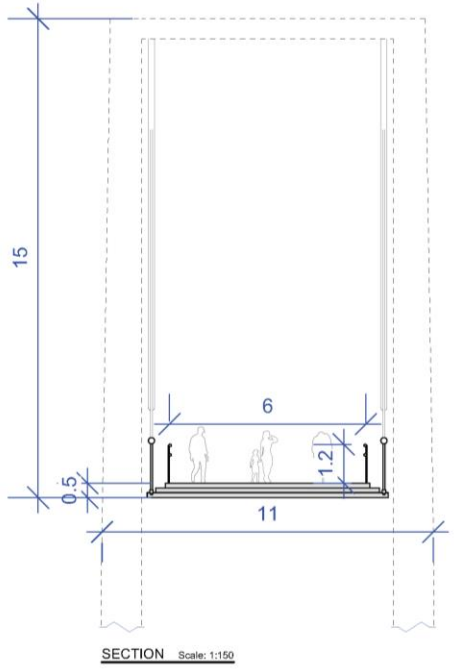
Suspension Bridge Option – Developed Concept Design



KEY PLAN Scale: 1:2000



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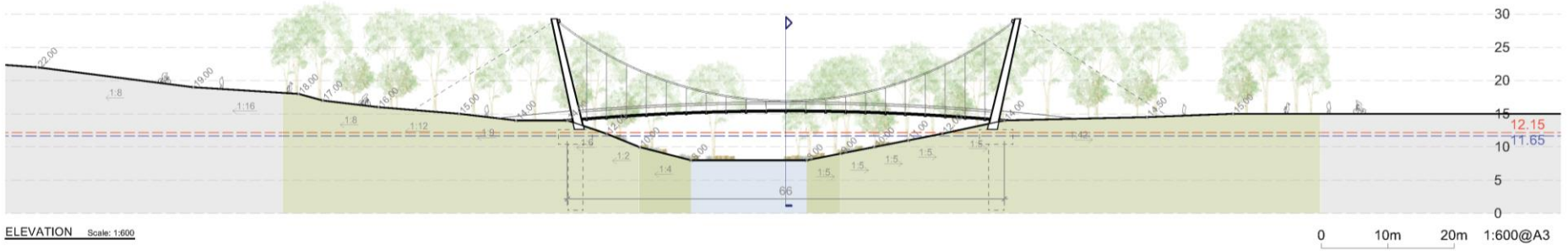
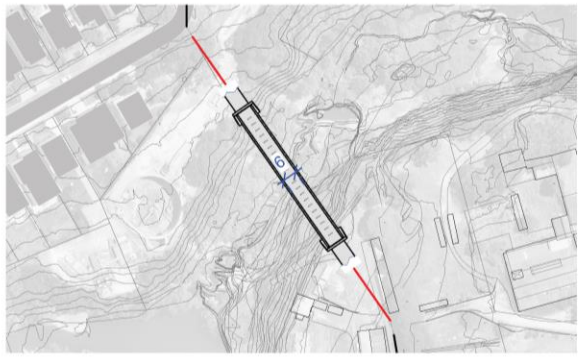


ELEVATION Scale: 1:600

Suspension Bridge Option – Developed Concept Design



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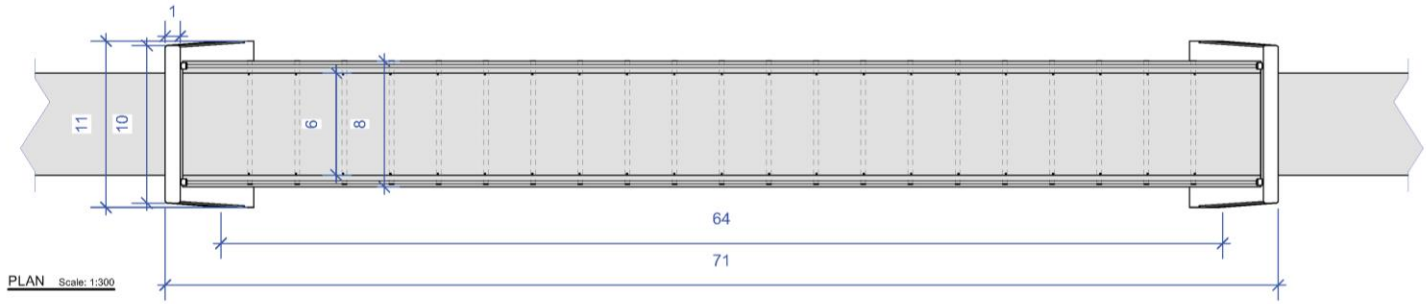

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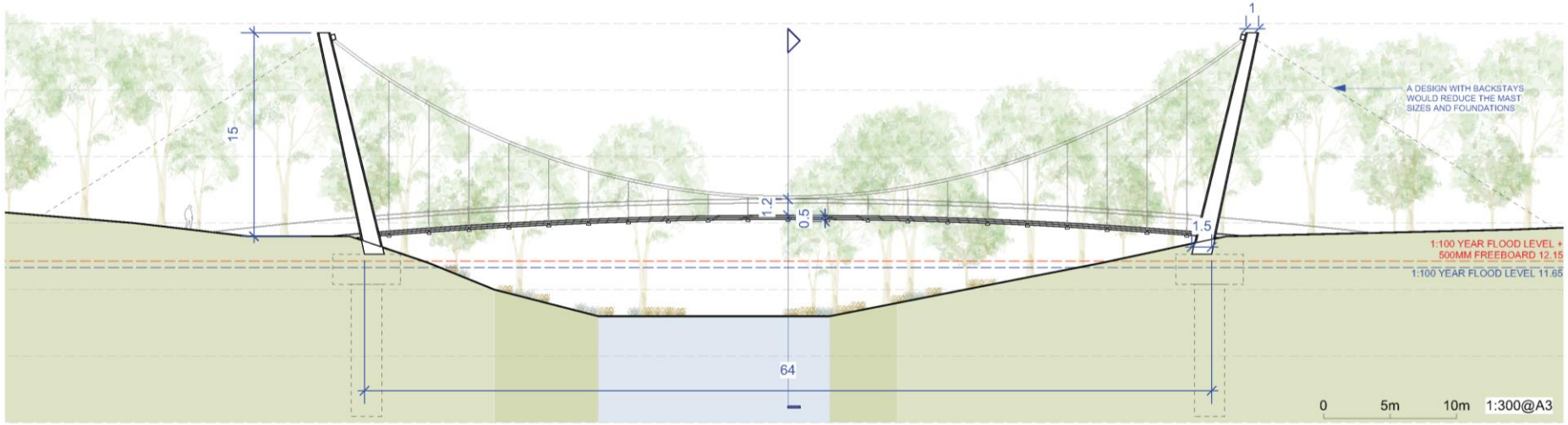
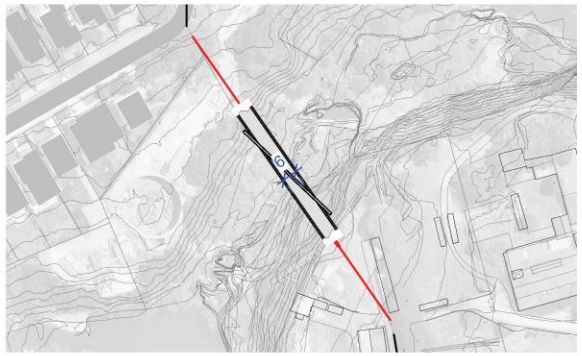


ELEVATION Scale: 1:300

ASPECT Studios

Arch Bridge Option – Developed Concept Design



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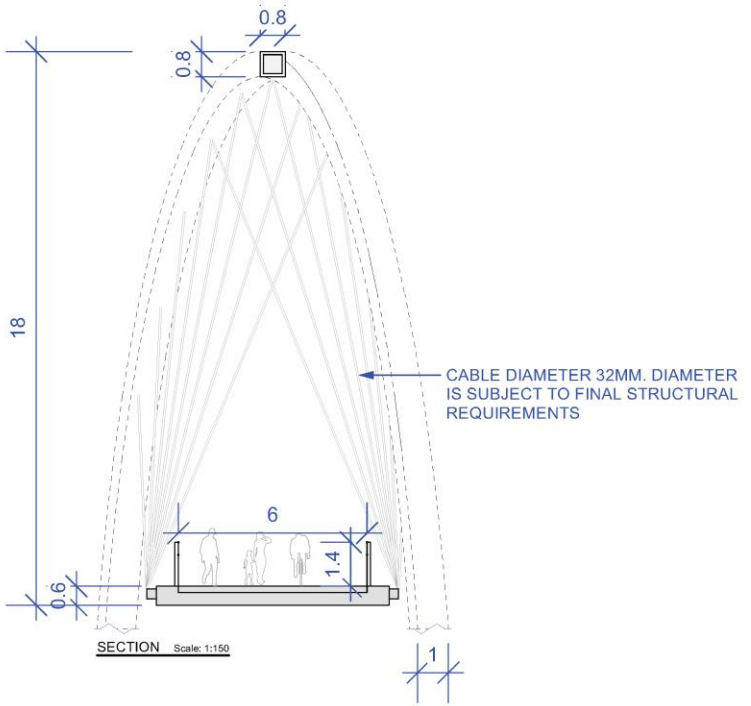

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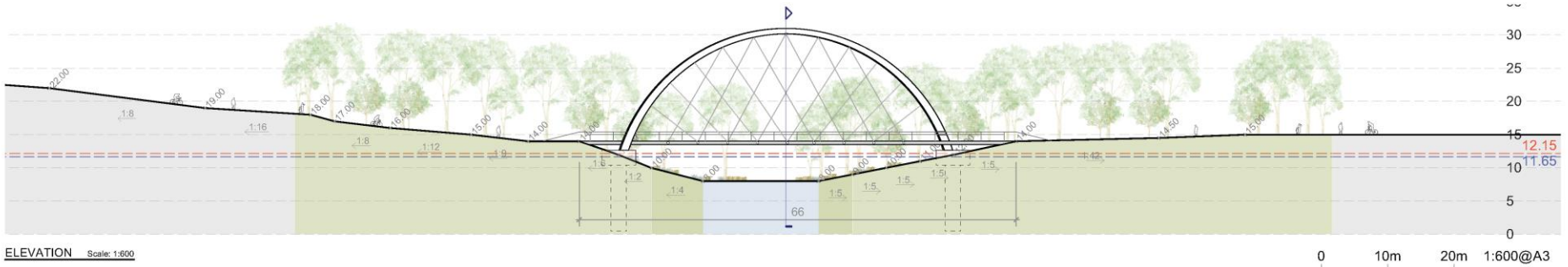
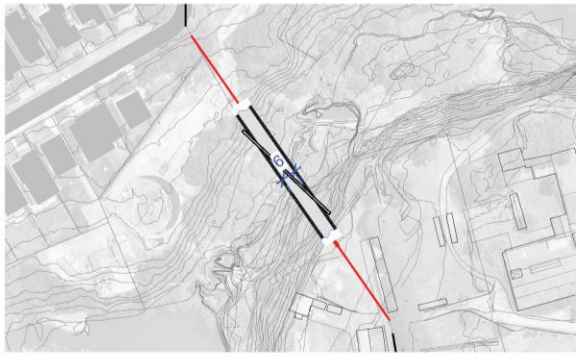


ELEVATION Scale: 1:600

Arch Bridge Option – Developed Concept Design



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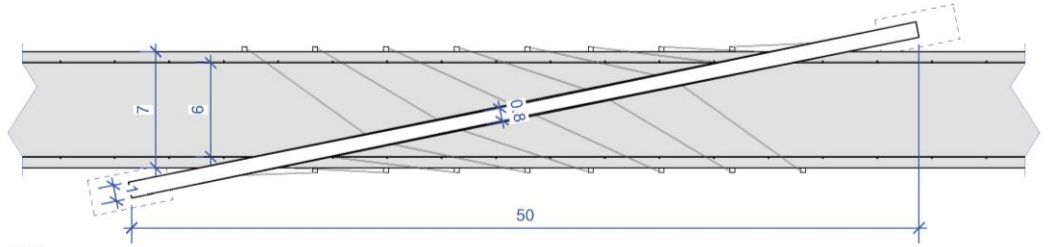

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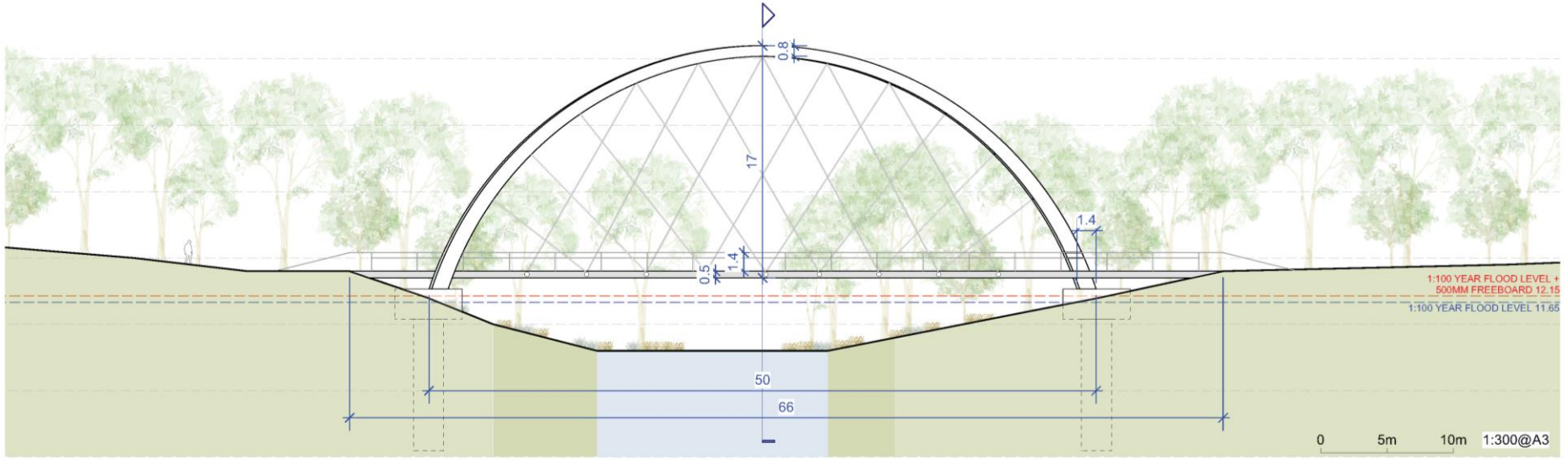
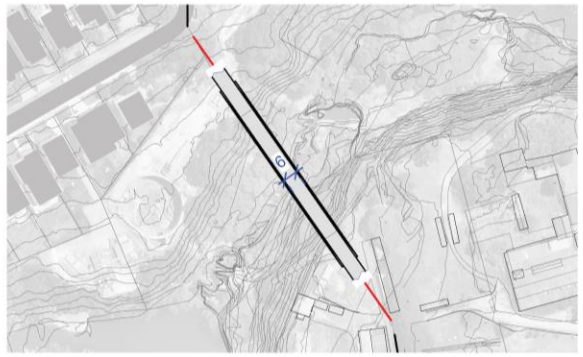


ELEVATION Scale: 1:300

ASPECT Studios

Steel Through Girder Bridge Option – Developed Concept Design



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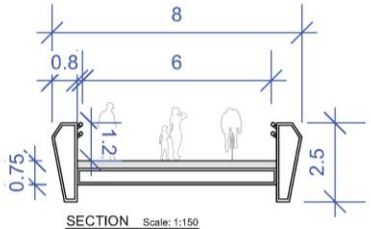

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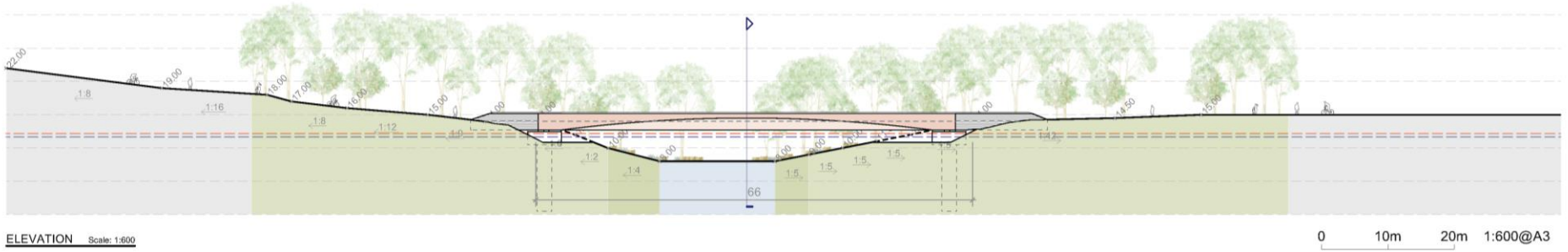

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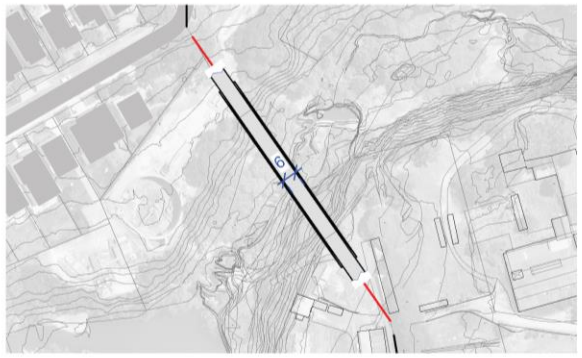
Steel Through Girder Bridge Option – Developed Concept Design



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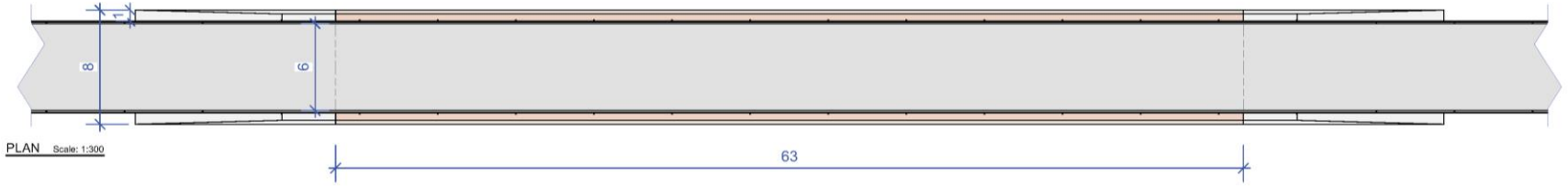

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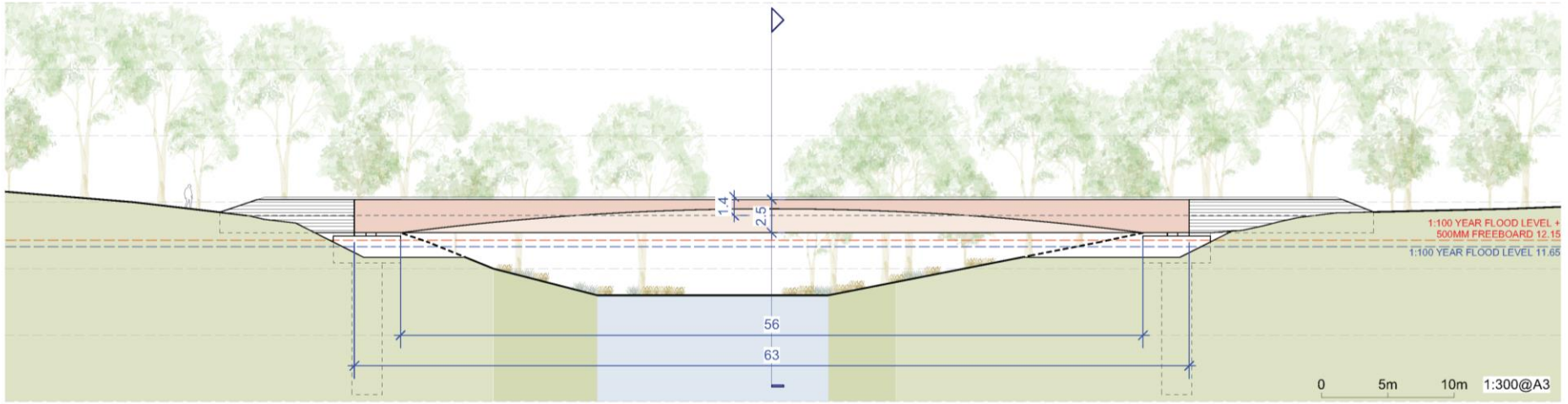


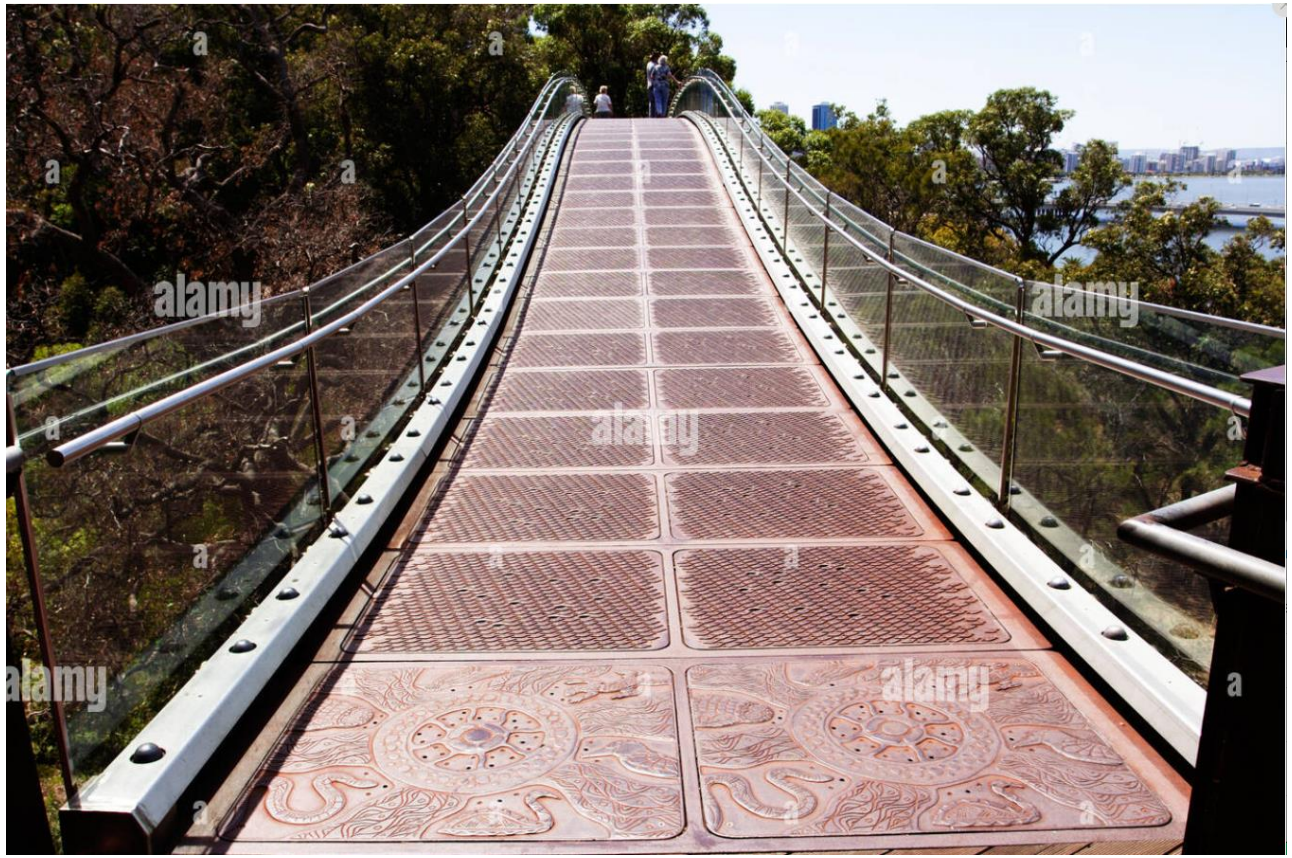
ELEVATION Scale: 1:300

5. Best practice examples

Opportunity for Cultural Expression – Deck Surface

King's Park Walkway, Perth

- Traditional Aboriginal art cast on an elevated walkway



Opportunity for Cultural Expression – Deck Surface

Nelson Street Cycleway, Auckland

- "A dynamic magenta surface and Māori designs, including a 140 square metre koru pattern at the northern end. The project team worked with Māori artist Katz Maihi and iwi throughout the urban design stages to include Māori designs and ensure the path has a distinctly New Zealand identity."

Appendix 1

Opportunity for Cultural Expression – Deck Surface

The Kids Bridge, Perth

- ‘It’s quite playful because you don’t understand what it is, and when you do find something you get excited about telling someone else what you can see’. This is how Aboriginal artist Kamsani Bin Salleh describes his stunning mural that forms part of the Kids Bridge Project.

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Appendix 1

Opportunity for Cultural Expression - Arches

Memorial Bridge, Christchurch

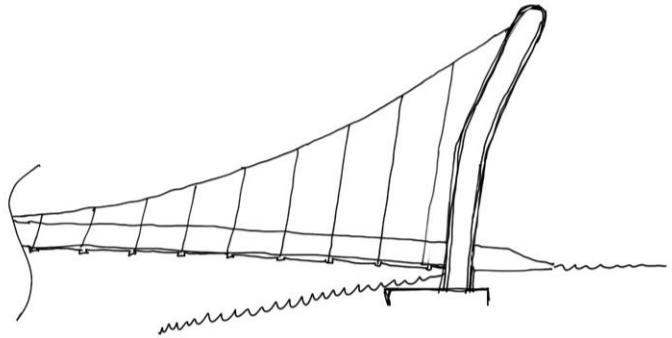
- "The two arcs cross paths to symbolise the convergence of Māori and European settlers; paths which take on different perspectives when viewed from different angles."

Appendix 1

Opportunity for Cultural Expression –Towers

Causeway Pedestrian and Cyclist Bridges, Perth

- "The design reflects and embeds Whadjuk Noongar culture, recognising the significance of Aboriginal heritage at Heirisson Island and the Swan River. Integral to the design are references to prominent Whadjuk Noongar people. These references will include the following: Yagan is a young warrior leader represented by a boomerang-inspired pier. Balbuk fought to retain the Swan-Coastal Plain's over-development and is represented by two digging stick-inspired piers."



Masts of the suspension bridge could be designed to replicate the form of a boomerang or other culturally appropriate reference. Subject to detailed design and engineering input.

Appendix 1

Opportunity for Cultural Expression - Abutment

Berri Bridge, Berri (SA)

- "Underneath the Berri Bridge, and at one end of the Berri Riverfront Walk, this mural depicts the Aboriginal heritage of the area. The mural shares the Dreaming story of the local Ngurinderi people. and the origins of the Murray."

Opportunity for Cultural Expression - Abutment

Tirohanga Whanui Bridge, Auckland

- "Graham Tipene and Mana Whenua guided us in the cultural understanding of the kōrero (story) and we listened. We in turn collaborated in taking the artistic concepts of the valleys and ridges and integrated them into the handrail and safety screen design with triangular patterns."

Opportunity for Cultural Expression - Balustrade

Bara Bridge, Sydney

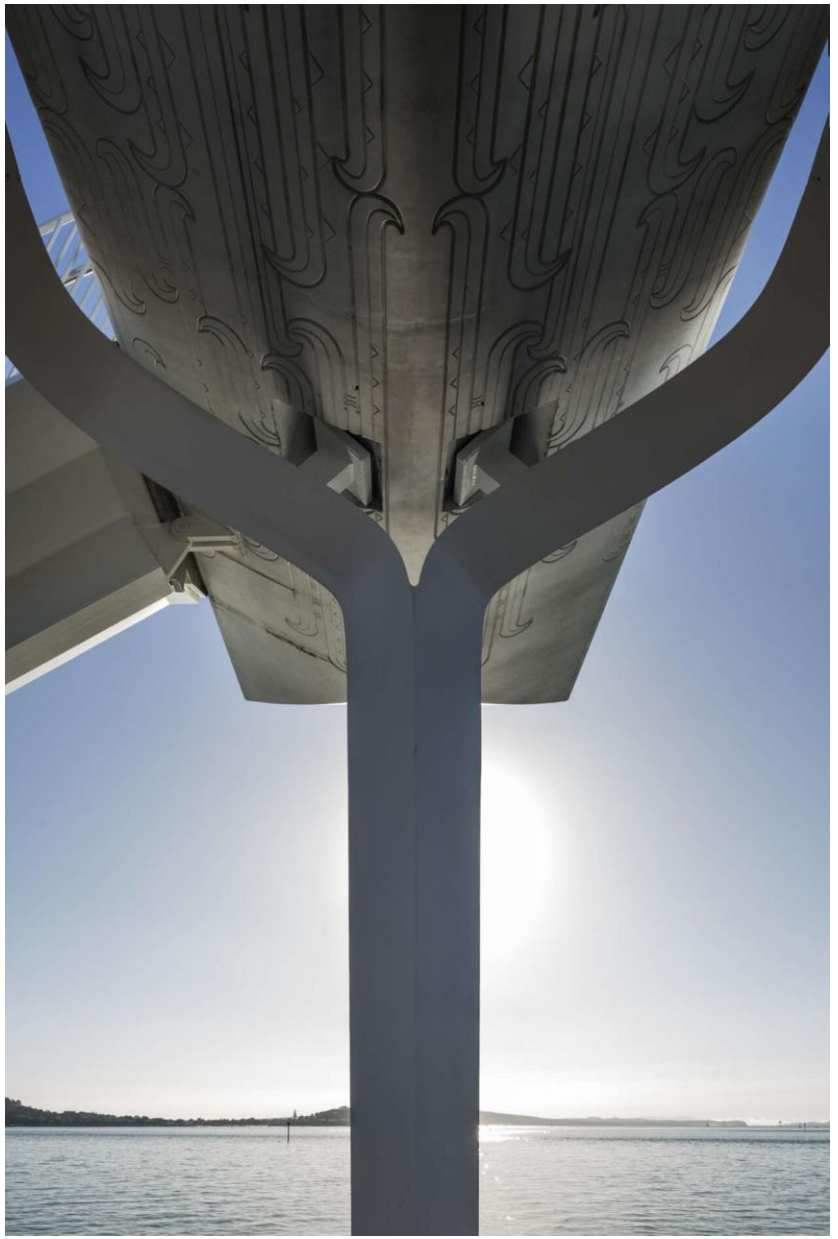
- “The shape, movement and color of the long-finned eels is reflected in the form and materiality of the bridge design. The bridge celebrates ancient Indigenous culture and is an environmentally sensitive addition to the vast Centennial Parklands, linking them to surrounding areas in inner Sydney.”

Appendix 1

Opportunity for Cultural Expression - Underside

Point Resolution Bridge, Auckland

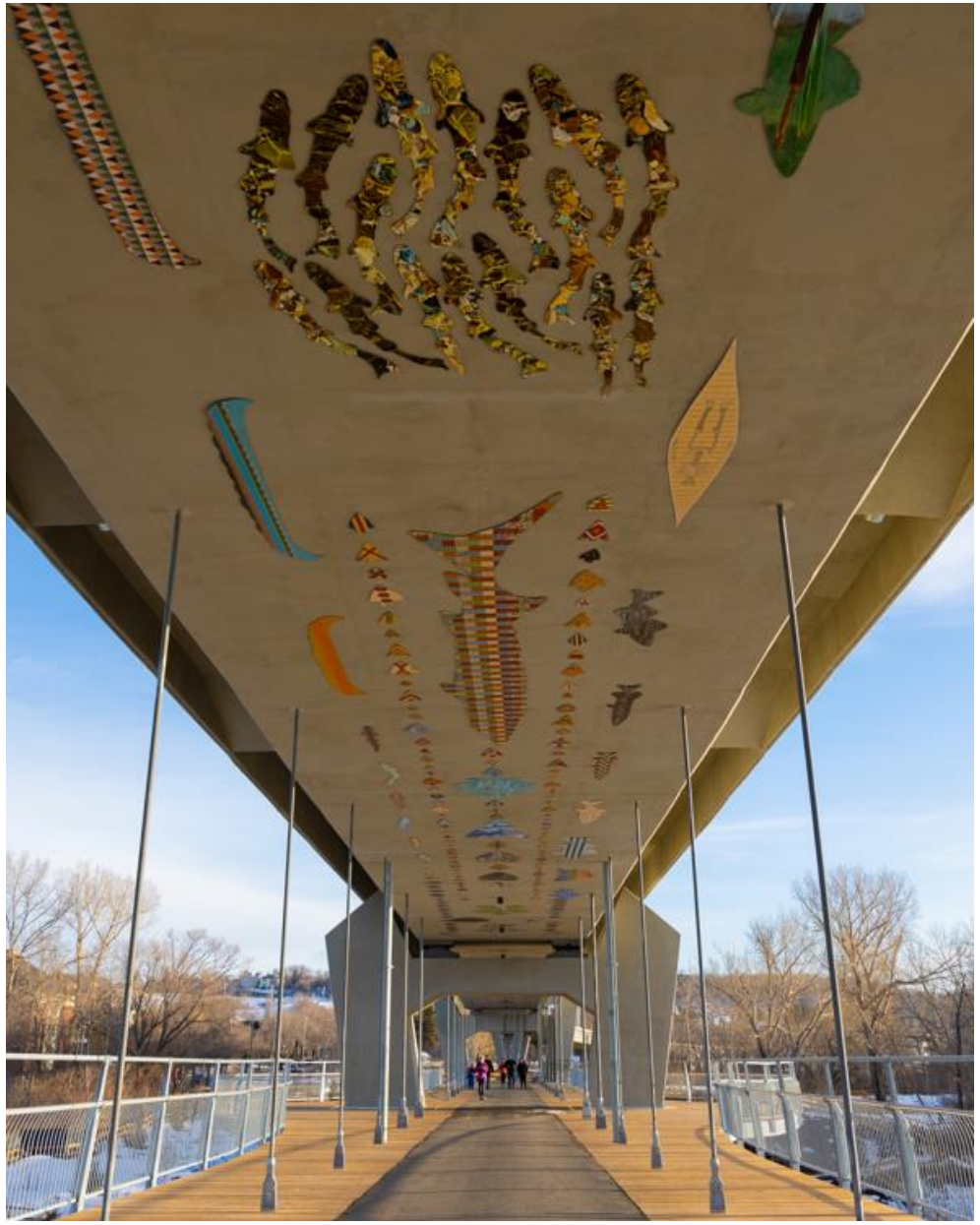
- "The deck consists of a simple shaped concrete beam - hull-like in shape alluding to the yachts and the harbour beyond."
- "Local artist Henriata Nicholas designed a custom pattern that speaks of movement and water which was engraved into the concrete beam and the glass balustrade."



Opportunity for Cultural Expression - Underside

Tawatine Bridge, Canada

- "The paintings show the intertwined lives of the people and the non-human beings who live and travel through here. The artist's meetings with First Nations Elders, knowledge keepers, and Métis citizens, and numerous visits to the valley since childhood, are the backbone of these paintings."



Opportunity for Cultural Expression - Sides

Point Resolution Bridge, Auckland

- "Key design factors at play were the harbour location and the visual language of the nearby Parnell Baths with its mosaic mural depicting abstract swimmers. The result is a new contemporary bridge conceived as a series of three sculpted arches, in turn supporting and cradling a pedestrian deck."

Appendix 1

Opportunity for Cultural Expression - Sides

Provencher Bridge, Winnipeg

- "Symbols for flying birds, the sun, flowers, fish, feathers, hills and waterfowl are etched into the stone almost like fossils as well as some ribbons or ropes that are reminiscent of the bridge's cables or Metis sashes."