APPENDIX B. STRUCTURAL ENGINEERING ADVICE

MARK HODKINSON PTY LTD
Consulting Structural Engineers

Structural Engineering Advice

Chinamans Bridge

Nagambie

Prepared by

Mark Hodkinson Pty Ltd

27th May 2024

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M A R K H O D K I N S O N P T Y L T D
C o n s u l t i n g S t r u c t u r a l E n g i n e e r s

Ms Corinne Softley
Extent Heritage
Level 1, 52 Holmes Street
Brunswick East 3057

Dear Corinne,

Re : Structural Engineering Advice
Chinamans Bridge
Nagambie

We are writing to present our structural engineering advice that pertains to the condition of Chinamans Bridge, which crosses the Goulburn River on the Nagambie-Heathcote Road, Nagambie. The historic timber bridge sustained damage during several recent floods of the Goulburn River and hence the need for the structural engineering advice.

1 Extent's Brief

From your brief we understand that Heritage Victoria have requested the following take place :-

- Investigate the condition of all structural members to determine their integrity. Suitable methods for the assessment include hammer sounding, micro resistance drilling and visual assessments. Structurally assess the bridge for future use and determine necessary repairs/upgrades and future safe load. Address any critical issues.

It should be noted that the advice does not include the documentation of the remedial works.

2 Heritage Victoria's Citation

Extracts from the Victorian Heritage Database follow :-

"*Chinamans Bridge is an extensive timber bridge which spans the Goulburn River 2.7 kilometres west of the Goulburn Valley Highway. It is believed to have been constructed in 1891 and at the time was known as Kerris Bridge. The bridge was funded with a joint grant from the Public Works Department and the Water Supply Department. It was designed by the Goulburn Shire Council Engineer and constructed by the contractor JB Parkinson. The bridge included a lift span to enable sawmill and recreation steamers to continue to utilise the Goulburn River. Chinamans Bridge originally carried the Nagambie-Heathcote Road across the Goulbourn River, however the road has now been re-aligned to be carried over*

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the river by a new bridge nearby. Chinamans Bridge is a timber girder bridge with hand hewn square stringers strutted to the piers and timber corbels and deck. The drawbridge span was replaced around 1940 with a steel span."

3 Description of Bridge Construction

Chinamans Bridge is a fifteen span approximately 111 m long bridge of timber construction with a single steel beam span where the lift span once existed. Each end of the bridge has been fenced off to prevent pedestrian traffic, as the bridge deck has been deemed unsafe due to missing planks, failed cross-beams and areas of partial collapse. Refer to Appendix A for typical views of the bridge structure and the damage, and Appendix B for drawings of the bridge, and in particular drawings S2 to S4 for the bridge components.

The structure composes the following :-

3.1 Rectangular hardwood (HW) timber planking nominally 100 mm deep X 200 mm wide, running longitudinally along the deck and covered with asphalt.

3.2 Regularly spaced rectangular HW cross-beams nominally 200 mm deep X 175 wide spanning transversely, supporting the deck.

3.3 For spans 1 to 3, five round HW log and / or 'new' rectangular HW stringers per span of nominally 500 mm diameter or 500 X 500 mm, with rectangular HW corbels supported from the trestles.

3.4 For spans 4 to 9 and 11 to 15 five round log HW stringers per span of nominally 500 mm diameter with rectangular HW corbels, and retrofitted rectangular HW beams below the stringers of nominally 500 X 500 mm, which are strutted off the trestles via rectangular HW knee braces also of nominally 500 X 500 mm. Note that although the new beams are also stringers we shall refer to them as new beams in order to avoid confusion.

3.5 For span 10 four steel RSJ girders supported from HW rectangular blocking above the trestle cross- heads, and

3.6 Fourteen trestles constructed from vertical round HW piles and typically two inclined batter round HW piles, all of nominally 500 mm diameter each, with rectangular HW cross-head beams, bracing and walers.

3.7 The abutments at either end are constructed with round HW soldier piles of nominally 500 mm diameter each and rectangular HW infill planking.

It should be noted that historic timber bridges can be somewhat like the proverbial 'grandfather's axe', whereby over time many components of the bridge are replaced with new and sometimes like-for-like components as the original components are deemed unserviceable.

4 Inspection, Photography and Investigation

An inspection of the trestles and the underside of the bridge superstructure was undertaken from a kayak and the river banks, and a limited inspection of the decking, cross-beams and stringers was undertaken from the northern end of the bridge, where it was deemed safe to do so.

High-resolution digital photos were taken with a Canon EOS 6D 20.2 MP DSLR with 400X telephoto lens from the road bridge and the river banks, and a 4K drone was used to take photographs of the decking from above.

Destructive and non-destructive investigations were also undertaken and included 'sounding' the timber and drilling holes. Holes were drilled in a number of the piles in order to assess the extent of the internal pipe-rot (lengths of more-or-less round dry-rot that is only visible from the ends), and holes were also drilled into the tops of a number of the stringers in order to assess the depth of the dry-rot.

The bridge was surveyed by Measure Australia and architectural drawings were extracted from the survey data.

The inspection, investigation and digital photography revealed the following for the sections of the bridge that have not partially collapsed :-

4.1 Decking

In general the HW decking appears to be in reasonable condition albeit the ends of the planks have dry-rot, and the asphalt coating may have been applied to 'patch' and even the tops of the planking. Refer to photographs 1 to 4, Appendix C.

4.2 Cross-beams

The HW cross-beams are in generally poor condition and many of them have failed. Further, the numerous bolts and plates that have been retrofitted along the sides and below the cross-beams to secure the planks in position, indicates that the tops of the cross-beams have deteriorated and no longer hold the dog spikes that were originally used to fix the planks. Refer to photographs 5 to 7, Appendix C.

4.3 Stringers

Where the new beams have been installed below the stringers (spans 4 to 15) the underside of the stringers are not visible and hence it is probable that the new beams were installed because the stringers were no longer serviceable. In general the new beams appear to be in serviceable condition.

Where new beams have not been installed below the stringers (spans 1 to 3) some of the stringers have full depth splits and others have collapsed. Where the decking is missing, a number of the stringers have extensive channel-dry-rot in their tops (rot

in the middle of the section). Where the decking is intact and the tops of the stringers are not visible, the test drilling between the gaps in the planks found that there was extensive dry-rot in the tops of the stringers. Hence it is probable that the majority of the stringers have either channel-dry-rot in their tops or extensive pipe-rot. Refer also to photographs 8 to 11, Appendix C.

4.4 Corbels

In general where the ends of the corbels are visible they appear to be in serviceable condition, albeit some have splits and pipe rot. Refer to photographs 12 to 14, Appendix C.

4.5 New Beams

In general the new beams appear to be in serviceable condition. Refer to photographs 15 to 17, Appendix C.

4.6 Knee Braces

In general the knee braces appear to be in serviceable condition. Refer to photographs 18 to 20, Appendix C.

4.7 Cross-head Beams

In general the cross-head beams appear to be in serviceable condition, with the exception of the beams that support the steel beams at Trestle 10, ie the trestle that support the southern end of the steel beams. Refer to photographs 21 and 22, Appendix C.

4.8 Trestles

In general the piles of Trestles 2 to 14 (the trestles within the river) are in poor condition at the river level, and of the 92 piles of those trestles, 57 piles (62%) are in Condition State 4, 17 piles (18 %) are in Condition State 3, and the remaining 18 piles (20%) are in Condition State 2, in accordance with the RTA Bridge Inspection Manual (June 2007)).

Condition State 4 is defined as "*Advanced deterioration, heavy decay, insect infestation, splits, cracks or crushing has produced loss of strength that affects serviceability of the bridge*". Condition State 3 is defined as "*Medium decay, insect infestation, splitting, cracking or crushing has produced loss of strength of the element but not of a sufficient magnitude to affect the serviceability of the bridge*." Condition State 2 is defined as "*Minor decay, insect infestation, splitting, cracking, checking or crushing may exist but none is sufficiently advance to affect serviceability.*" We have adopted the RTA Manual in lieu of the VicRoads Bridge Maintenance and Repair Manual as the RTA Manual is more explanatory, noting that both Manuals use a similar 1, 2, 3 and 4 rating system. Refer to photographs 23

to 29 Appendix C, drawings S6 to S12 Appendix B, and Appendix D for the RTA condition states.

The test drilling of the bases of the piles that were intact and located above the water line revealed pipe rot in the piles.

Although the walers and lower sections of the original bracing are in variable condition, the repair and augmentation works that have been implemented appear to be serviceable.

Where the Trestle 1 piles were investigated by Melbourne Geotechnics the piles were in very good condition below the ground level. Refer to Section 5 below.

4.9 Abutments

In general the central section of the northern abutment appears to be in serviceable condition, albeit the piles are in variable condition and two piles are missing from the western section, and the eastern section has partially collapsed.

In general the central section of the southern abutment appears to be in serviceable condition, albeit the piles are in variable condition.

5 Melbourne Geotechnics

Melbourne Geotechnics hand excavated test pits adjacent to the five vertical timber piles of Trestle 1 to depths of up to 1.1 m, and we inspected the below ground sections of the piles and found them to be in very good condition (ie Condition State 1). Refer to Appendix E.

6 Load Capacity Assessment

The Australian Standard AS1170.1 *Structural Design Actions part 1 : Permanent, imposed and other actions* specifies that structures that are subjected to crowd loadings shall be capable of supporting a live load of 4.0 kPa (407 kg/m^2) or 4.5 kN (458 kg), whichever produces the adverse loading. If the bridge were to be opened for unrestricted pedestrian access then the bridge would need to be capable of supporting these loadings.

Professor William Henry Warren (1852 – 1926), the Australian Engineer and Professor of Engineering at University of Sydney for 42 years, states in his textbook *Engineering Construction in Iron, Steel and Timber* (Longmans & Co 1894) that "*In a highway bridge, the greatest live load is generally produced by a dense crowd of people, which may be taken to weigh about 140 lbs per square foot* (6.7 kPa or 683 kg/m^2). *Such a dense crowd will rarely ever extend over the whole of the bridge excepting in towns, and the live load usually provided is somewhat as follows*". He states that for spans of between 0 and 30' (0 to 9.1m) he suggests a load of 100 to 120 lb/ft2 (4.8 to 5.7 kPa) and for 30' and 50' spans he suggests a load of 90 to 110 lb/ft2 (4.3

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to 5.2 kPa). Hence it is possible that the original bridge was designed for a live load of greater than 4.0 kPa.

With respect to the load capacity of the steel beams that are believed to have been installed around 1940, if the beams were designed in accordance with the 1936 Country Roads Board *Specification for the Design of Road Bridges* then the beams should have a load capacity of 100 lb/ft2 (4.8 kPa or 488 kg/m2).

In its present state the live load capacity of the timber structure is somewhere between zero and negligible and as such significant and extensive remedial works will need to be implemented to reinstate its structural capacity.

7 Remedial and Strengthening Works

A discussion of the remedial and strengthening works that would be required to achieve a live load capacity of 4.0 KPa or 4.5 kN follows. It should be noted that where the collapses have occurred the super-structure will need to be dismantled and then reconstructed.

7.1 Decking

As the decking has been laid in very long lengths it should be possible to dock the ends of the planks to remove the dry-rot, before relaying them. It should be noted that a 25% reduction of structural depth will still achieve the required live load capacity.

7.2 Cross-beams

Although the exact condition of the cross-beams will not be obvious until the decking has been removed it is probable that the great majority of the cross-beams will need to be replaced with durable seasoned timbers. If there are any cross-beams that are in a serviceable condition they will achieve the required live load capacity.

7.3 Stringers

Where new beams have not been installed below the stringers (spans 1 to 3) the stringers that have split apart and collapsed will need to replaced. Where the stringers have channel-dry-rot and there is sufficient timber left at the sides of the stringers, the channel-dry-rot can be removed and sections of seasoned durable timber epoxy grouted into the remaining channels. Where there is insufficient timber left then either the channel-dry-rot can be removed, sections of seasoned durable timber epoxy grouted into the channel and steel beams fixed either side to augment the strength of the stringer, or otherwise new steel beams are installed adjacent to the stringer.

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Where the stringers are in a serviceable condition they will achieve the required live load capacity, noting that their condition will need to be assessed following the removal of the decking and cross-beams.

7.4 Corbels

Where the corbels are in a serviceable condition they will achieve the required live load capacity, noting that their condition will need to be assessed following the removal of the decking and cross-beams.

7.5 New Beams

Where the new beams have been installed below the stringers (spans 4 to 15) it is probable that the new beams are in serviceable condition as their tops have been somewhat protected by the original stringers, and as such it may only be necessary to reset the beams where they have moved. Where the beams have split, and do not contain dry rot, then they can be stitched together with bolts and plates.

Where the new beams are in a serviceable condition they will achieve the required live load capacity, noting that their condition will need to be assessed following the removal of the decking and cross-beams.

7.6 Knee Braces

Where the knee braces have dislodged they will need to be reset and the bolted connections at either ends of the braces checked and replaced if necessary. Where the knee braces are in a serviceable condition they will achieve the required live load capacity, noting that their condition will need to be assessed.

7.7 Cross-head Beams

Notwithstanding that the cross-head beams appear to be in a serviceable condition, the tops of the beams will need to be inspected following the removal of the decking and cross-beams. If there is tunnel-dry-rot in the tops of the beams then they will need to be remediated as per the stringers – see Section 7.3. Where the HW blocking has crushed under the steel beam then the blocking will need to be replaced. Where the beams are in a serviceable condition they will achieve the required live load capacity.

7.8 Trestles

Where the Condition State of the piles is 4 then the piles will either need to be remediated or replaced with F27 seasoned durable HW with a natural durability class of 1 in accordance with Australian Standard AS1720.2 – *Timber Structures Part 2 : Timber Properties* (ie yellow box, ironbark, tallowwood, spotted gum or turpentine). Where a pile requires remediation at the river level then the DENSO Seashield system can be used to strengthen the piles and also fill the pipe-rot in the length of the pile. Where the piles have split steel clamps can be installed around

the clamps or PFC scabs can be installed to strengthen the pile. Otherwise the deficient sections of piles can be removed and new lengths of F27 seasoned durable HW with a natural durability class of 1 spliced in.

Where piles are missing the replacement piles should also be F27 seasoned durable HW with a natural durability class of 1.

Where the Condition State of the piles is 3 then the piles should be monitored for deterioration.

7.9 Timber Component Treatment and Protection

If the bridge is to be restored then we would recommend that all of the timber components are treated with a preservative (both internally and externally) and the piles are capped, and the other members are flashed over with galvanised sheeting.

8 Summary and Conclusion

In its present state the live load capacity of the timber structure is somewhere between zero and negligible and as such significant and extensive remedial works will need to be implemented to reinstate the bridge's structural capacity. These works are discussed in detail in Section 7.

We trust that the above is explanatory enough for your purposes and please do not hesitate to contact us on 9381 1239 or 0417 36 34 32 if you have any queries or require further information.

Yours faithfully,

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Consulting Structural Engineer
BE(Civil) Grad Dip Struct Comps MIE(Aust) CPEng NER M.ICOMOS RPE

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APPENDIX A

VIEWS OF THE BRIDGE

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APPENDIX A

VIEWS OF THE BRIDGE

Photograph 1

A view of the northern end of the western elevation.

APPENDIX A

VIEWS OF THE BRIDGE

Photograph 2

A part view of the eastern elevation showing the RSJ girders.

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APPENDIX A

VIEWS OF THE BRIDGE

Photograph 3

A view of the northern end of the eastern elevation.

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APPENDIX A

VIEWS OF THE BRIDGE

Photograph 4

A view of the northern abutment.

APPENDIX A

VIEWS OF THE BRIDGE

Photograph 5

A view of the southern abutment.

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APPENDIX A

VIEWS OF THE BRIDGE

Photograph 6

A view of the southern end of the deck.

APPENDIX A

VIEWS OF THE BRIDGE

Photograph 7

A view of a collapsed section of the deck.

APPENDIX A

VIEWS OF THE BRIDGE

Photograph 8

A view of the northern end of the deck.

APPENDIX A

VIEWS OF THE BRIDGE

Photograph 9

An aerial view of the deck.

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APPENDIX A

VIEWS OF THE BRIDGE

Photograph 10

A view of a typical trestle.

APPENDIX A

VIEWS OF THE BRIDGE

Photograph 11

A view of the western side of the trestles.

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APPENDIX A

VIEWS OF THE BRIDGE

Photograph 12

A view of the collapse at the southern end.

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APPENDIX A

VIEWS OF THE BRIDGE

Photograph 13

A view of the collapse at the southern end.

APPENDIX A

VIEWS OF THE BRIDGE

Photograph 14

A view of the collapse at the southern end.

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APPENDIX A

VIEWS OF THE BRIDGE

Photograph 15

A view of the collapse at the southern end.

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APPENDIX A

VIEWS OF THE BRIDGE

Photograph 16

A view of the collapse at the southern end.

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APPENDIX B

SCHEMATIC DRAWINGS OF THE BRIDGE

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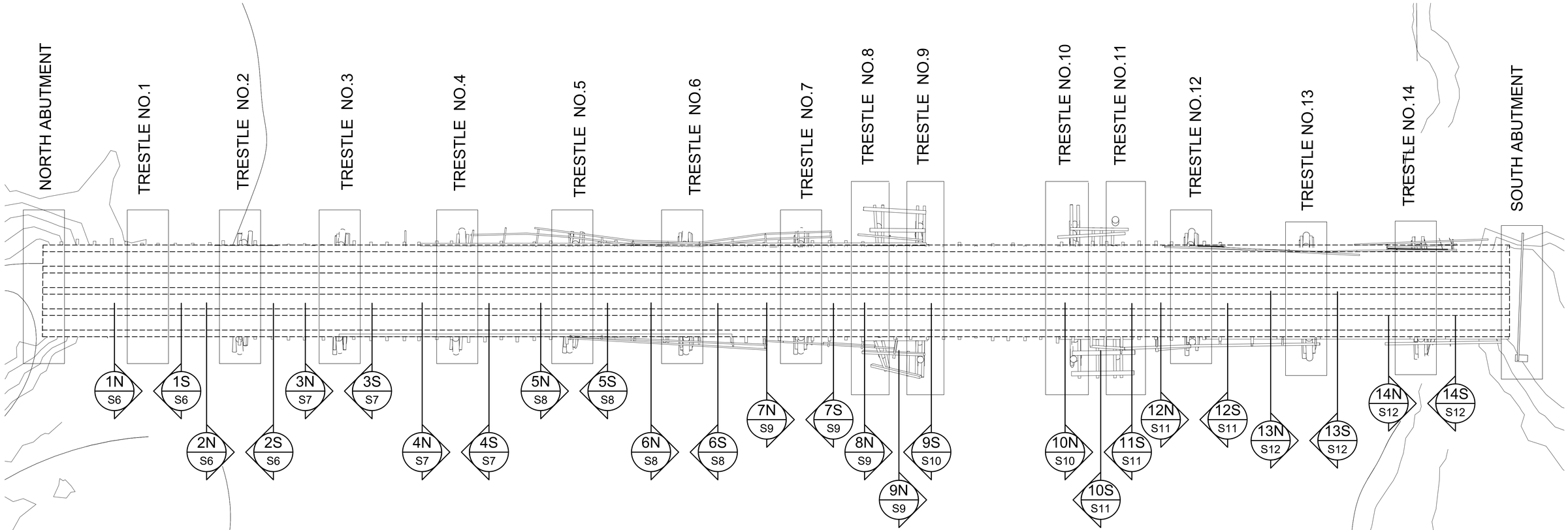

SITE PLAN
N.T.S.

PROJECT NORTH

PILE CONDITION STATES

Condition State 1

The timber is in good condition with no evidence of decay. There may be cracks, splits and checks having no effect on strength or serviceability.

Condition State 2

Minor decay, insect infestation, splitting, cracking, checking or crushing may exist but none is sufficiently advanced to affect serviceability.

Condition State 3

Medium decay, insect infestation, splitting, cracking or crushing has produced loss of strength of the element but not of a sufficient magnitude to affect the serviceability of the bridge.

Condition State 4

Advanced deterioration. Heavy decay, insect infestation, splits, cracks or crushing has produced loss of strength that affects the serviceability of the bridge.

No.	Date	Revision	By

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Heritage Consultant: EXTENT HERITAGE

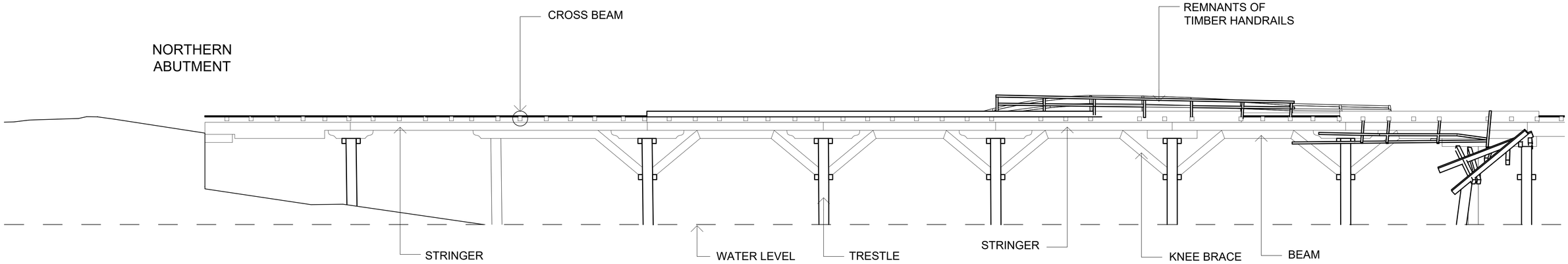
Client:

Project: STRUCTURAL ENGINEERING CONDITIONS SURVEY CHINAMANS BRIDGE NAGAMBIE

Drawn PWG
Design MH
Date MAY 2024
Scale AS SHOWN

Drawing Title: SITE PLAN

Project No	Dwg No.	Revision
3845	S1	A



WEST ELEVATION - NORTHERN END

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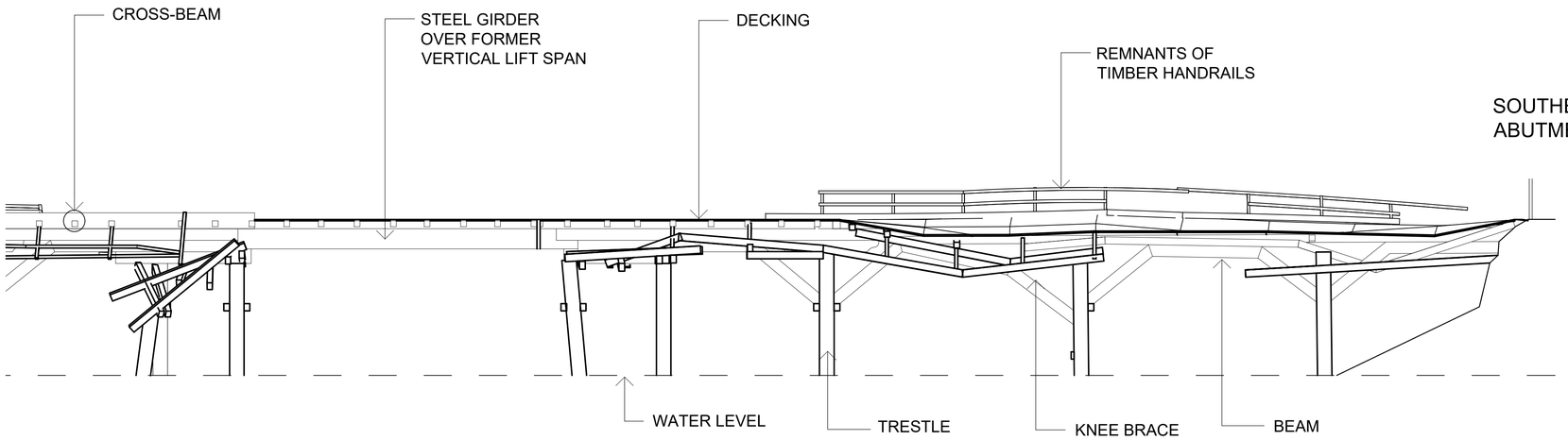

WEST ELEVATION - SOUTHERN END

1:100

No.	Date	Revision	By

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Heritage Consultant
EXTENT HERITAGE

Client

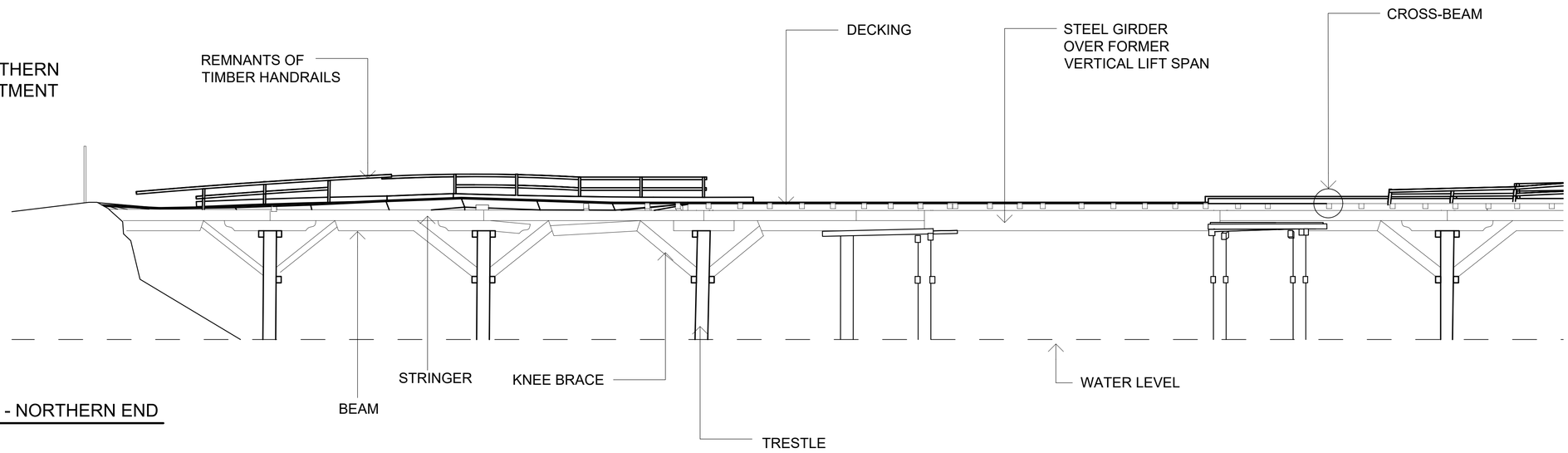
Project
STRUCTURAL ENGINEERING
CONDITIONS SURVEY
CHINAMANS BRIDGE
NAGAMBIE

Drawn PWG
Design MH
Date MAY 2024
Scale AS SHOWN

Drawing Title
WEST ELEVATION

Project No	Dwg No.	Revision
3845	S2	A

SOUTHERN
ABUTMENT



EAST ELEVATION - NORTHERN END

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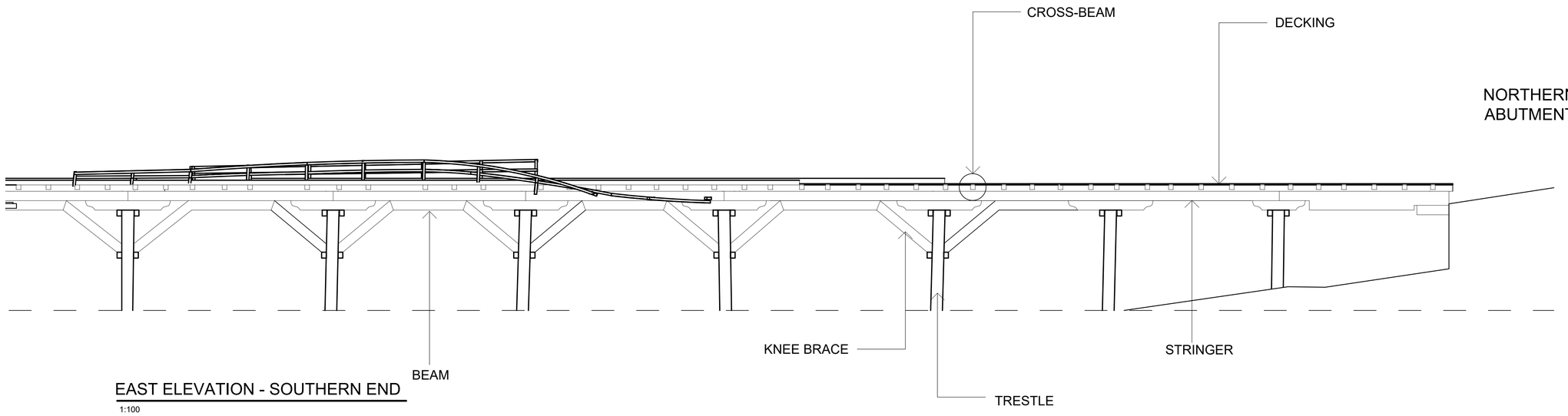
NORTHERN
ABUTMENT



EAST ELEVATION - SOUTHERN END

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Project
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CONDITIONS SURVEY
CHINAMANS BRIDGE
NAGAMBIE

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Design MH
Date MAY 2024
Scale AS SHOWN

Drawing Title
EAST ELEVATION

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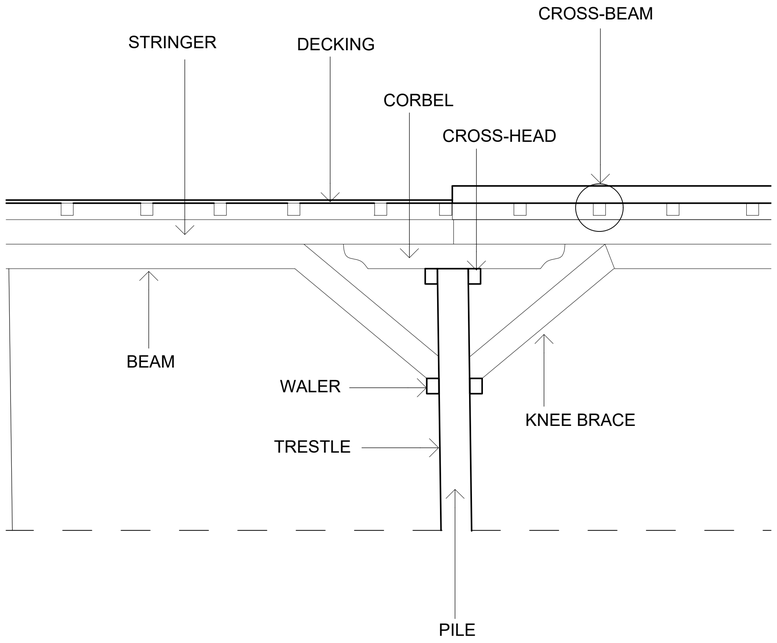
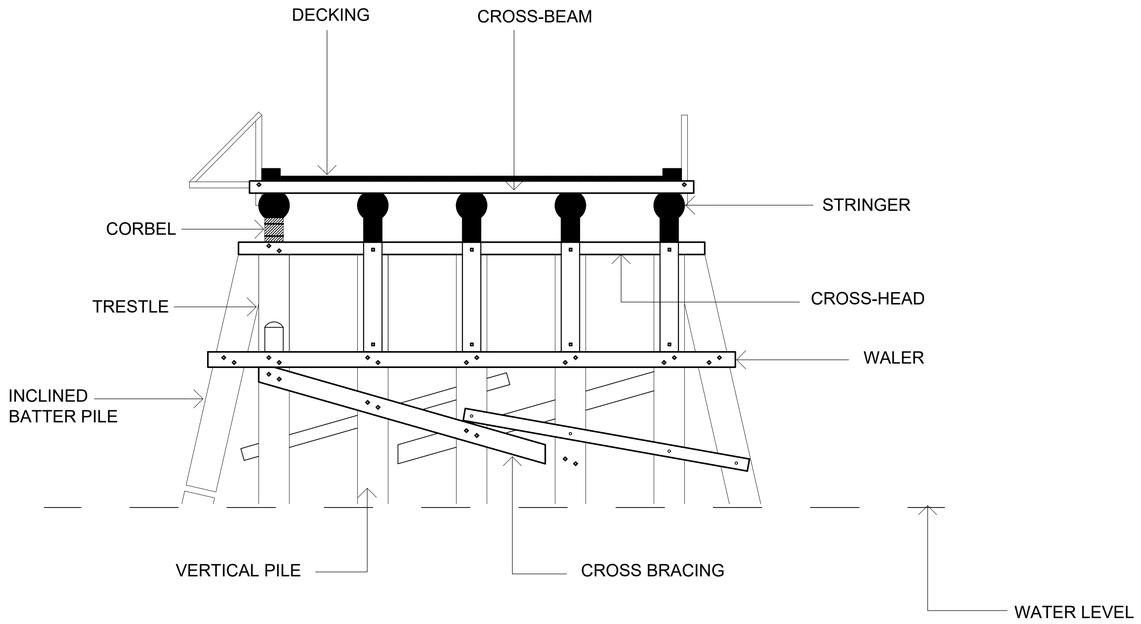


PART ELEVATION SHOWING BRIDGE COMPONENTS

1:50



SECTION SHOWING BRIDGE COMPONENTS

1:50

No.	Date	Revision	By

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NAGAMBIE

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Drawing Title
BRIDGE COMPONENTS

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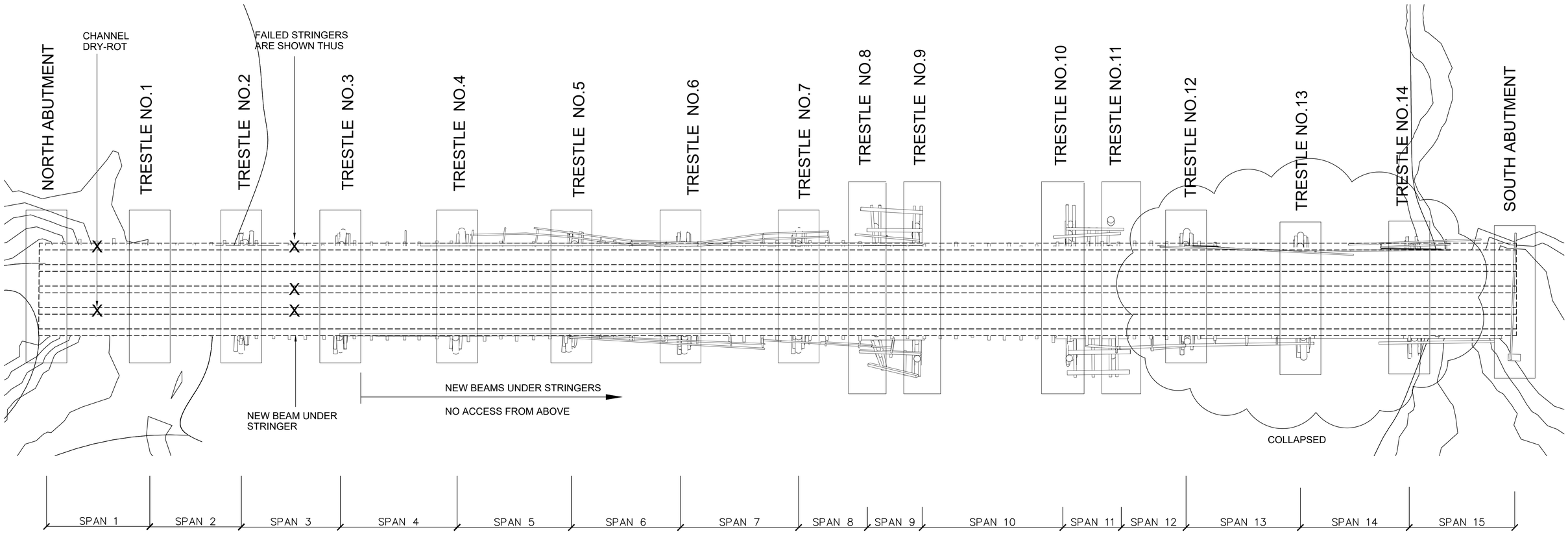

STRINGER PLAN

N.T.S.

No.	Date	Revision	By

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CHINAMANS BRIDGE
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Date MAY 2024
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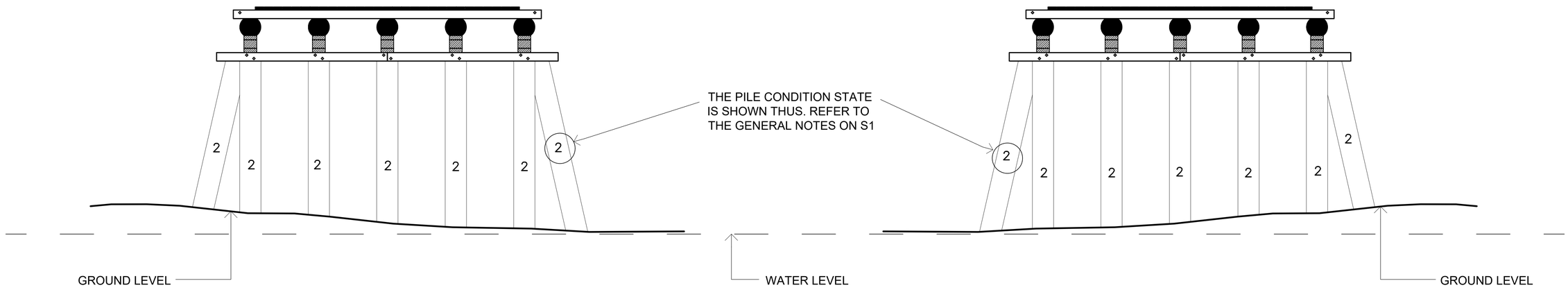
Drawing Title
STRINGER PLAN

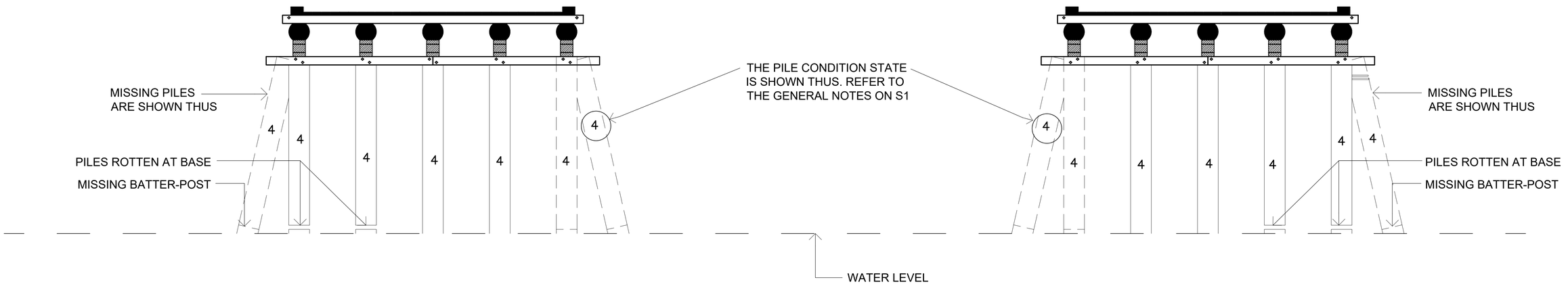
Project No	Dwg No.	Revision
3845	S5	A



SECTION (1N / S1) TRESTLE No. 1 NORTH VIEW
1:50

SECTION (1S / S1) TRESTLE No. 1 SOUTH VIEW
1:50

REFER TO THE GENERAL NOTES ON S1
FOR THE PILE CONDITION STATES



SECTION (2N / S1) TRESTLE No. 2 NORTH VIEW
1:50

SECTION (2S / S1) TRESTLE No. 2 SOUTH VIEW
1:50

No.	Date	Revision	By

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Heritage Consultant: EXTENT HERITAGE

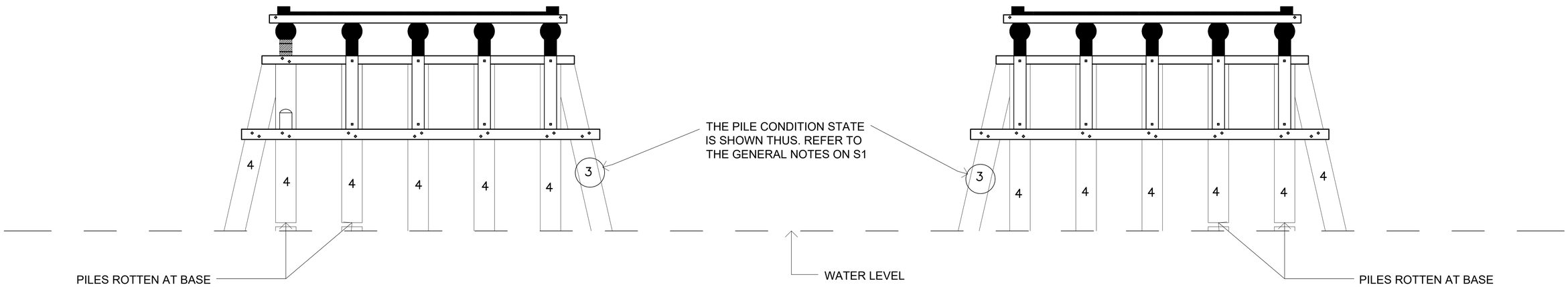
Client:

Project: STRUCTURAL ENGINEERING CONDITIONS SURVEY CHINAMANS BRIDGE NAGAMBIE

Drawn PWG
Design MH
Date MAY 2024
Scale AS SHOWN

Drawing Title: SECTIONS

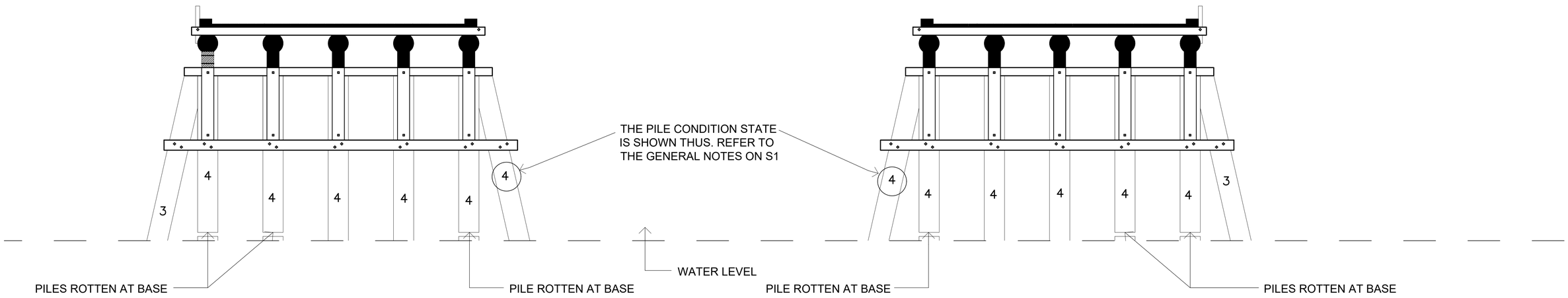
Project No	Dwg No.	Revision
3845	S6	A



SECTION 3N / S1 TRESTLE No. 3 NORTH VIEW
1:50

SECTION 3S / S1 TRESTLE No. 3 SOUTH VIEW
1:50

REFER TO THE GENERAL NOTES ON S1
FOR THE PILE CONDITION STATES



SECTION 4N / S1 TRESTLE No. 4 NORTH VIEW
1:50

SECTION 4S / S1 TRESTLE No. 4 SOUTH VIEW
1:50

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION PURPOSES

No.	Date	Revision	By

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Date MAY 2024
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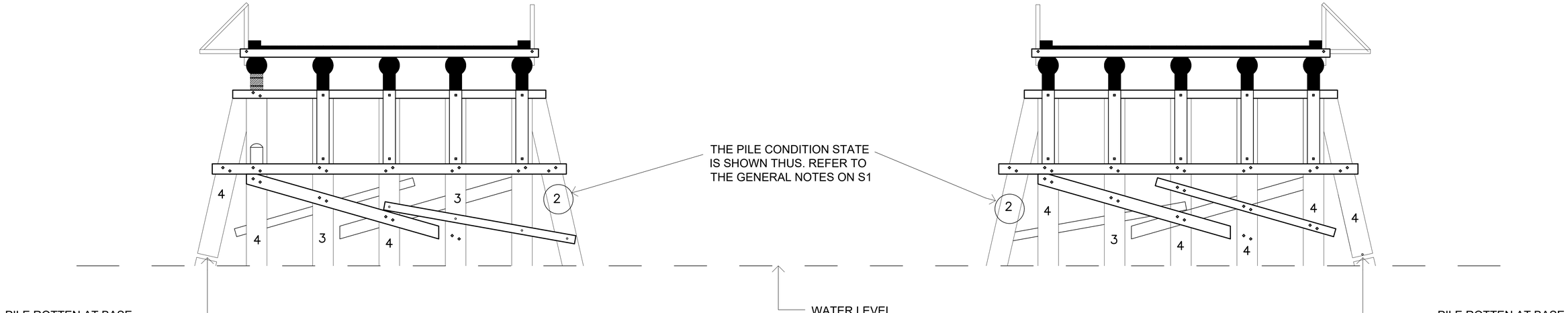
Drawing Title: SECTIONS

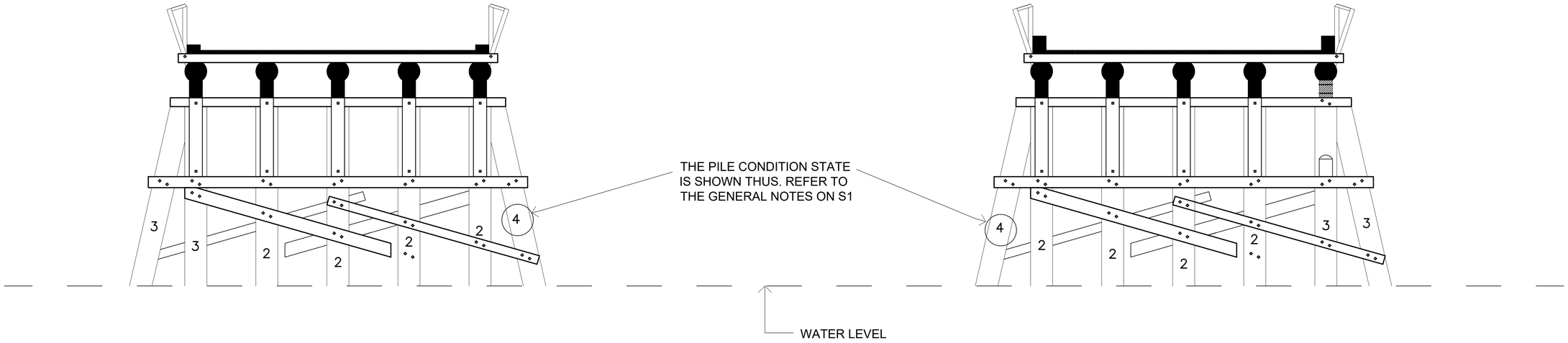
Project No	Dwg No.	Revision
3845	S7	A



SECTION 5N / S1 TRESTLE No. 5 NORTH VIEW
1:50

SECTION 5S / S1 TRESTLE No. 5 SOUTH VIEW
1:50

REFER TO THE GENERAL NOTES ON S1
FOR THE PILE CONDITION STATES



SECTION 6N / S1 TRESTLE No. 6 NORTH VIEW
1:50

SECTION 6S / S1 TRESTLE No. 6 SOUTH VIEW
1:50

No.	Date	Revision	By

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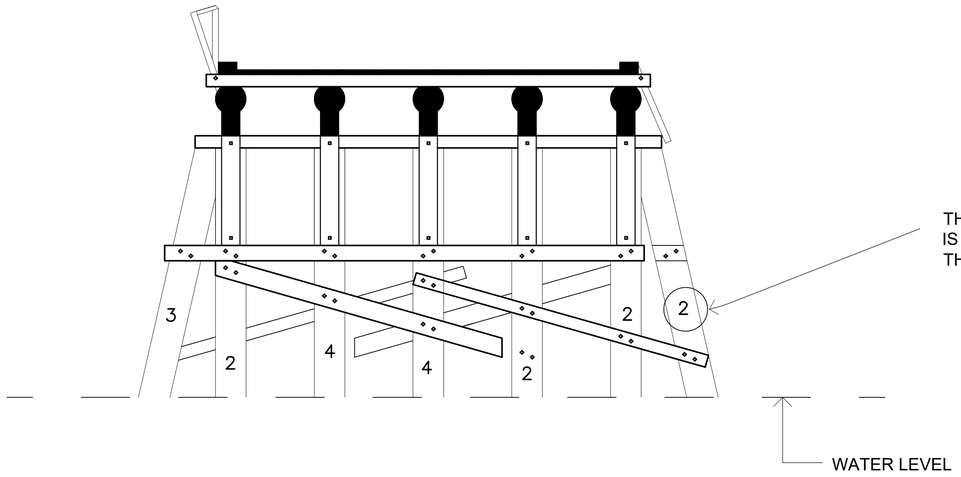
Project
STRUCTURAL ENGINEERING
CONDITIONS SURVEY
CHINAMANS BRIDGE
NAGAMBIE

Drawn PWG
Design MH
Date MAY 2024
Scale AS SHOWN

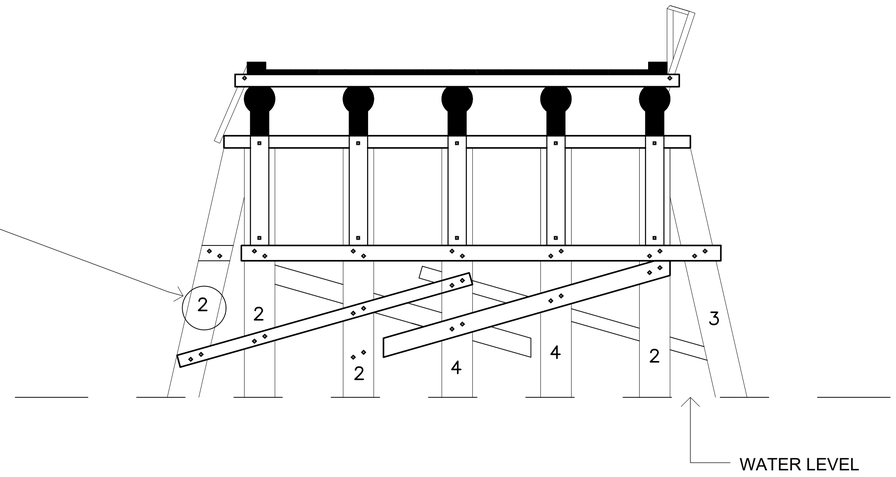
Drawing Title
SECTIONS

Project No	Dwg No.	Revision
3845	S8	A



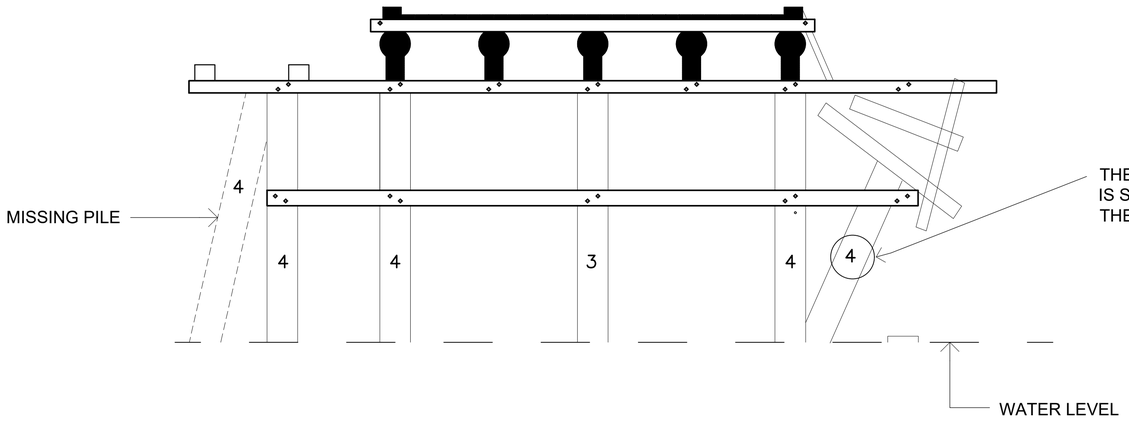
THE PILE CONDITION STATE IS SHOWN THUS. REFER TO THE GENERAL NOTES ON S1

SECTION 7N / S1 TRESTLE No. 7 NORTH VIEW
1:50



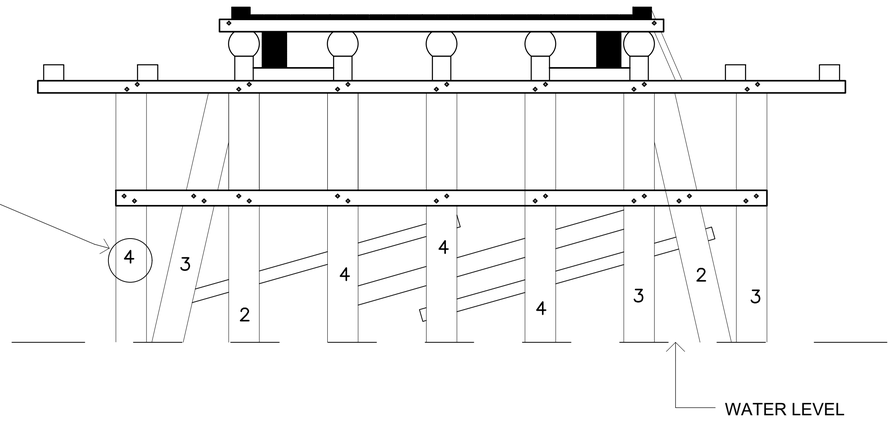
SECTION 7S / S1 TRESTLE No. 7 SOUTH VIEW
1:50

REFER TO THE GENERAL NOTES ON S1
FOR THE PILE CONDITION STATES



THE PILE CONDITION STATE IS SHOWN THUS. REFER TO THE GENERAL NOTES ON S1

SECTION 8N / S1 TRESTLE No. 8 NORTH VIEW
1:50



SECTION 9N / S1 TRESTLE No. 9 NORTH VIEW
1:50

No.	Date	Revision	By

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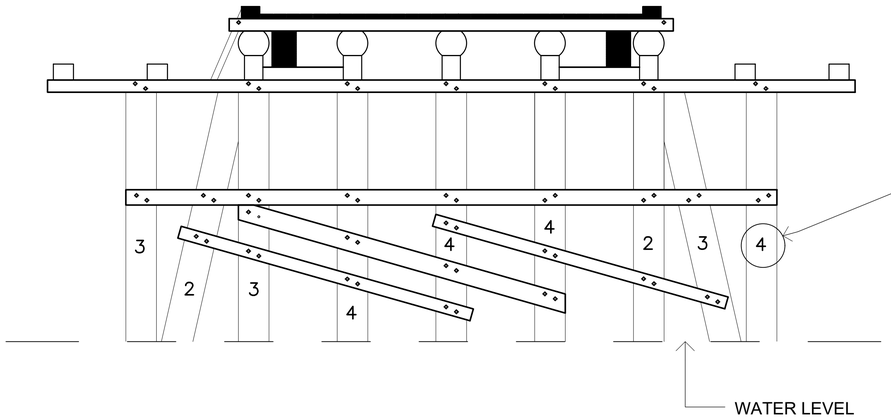
CHINAMANS BRIDGE
NAGAMBIE

Drawn PWG
Design MH
Date MAY 2024
Scale AS SHOWN

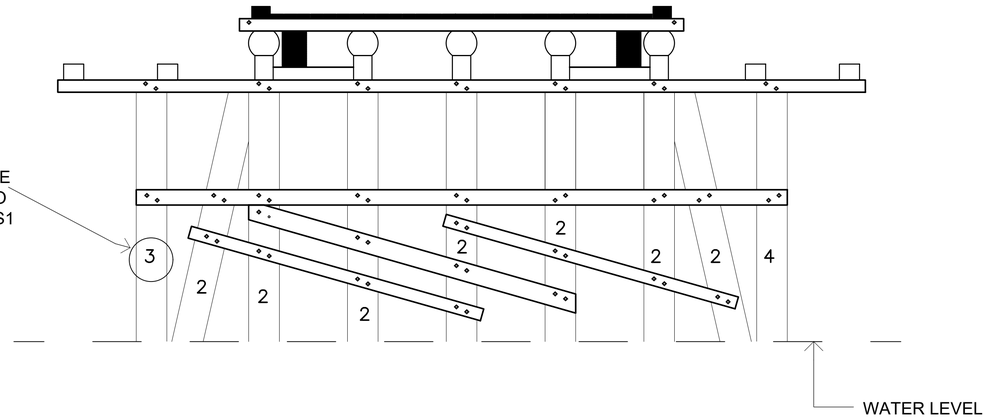
Drawing Title
SECTIONS

Project No	Dwg No.	Revision
3845	S9	A



SECTION 9S / S1 TRESTLE No. 9 SOUTH VIEW
1:50

THE PILE CONDITION STATE IS SHOWN THUS. REFER TO THE GENERAL NOTES ON S1



SECTION 10N / S1 TRESTLE No. 10 NORTH VIEW
1:50

REFER TO THE GENERAL NOTES ON S1
FOR THE PILE CONDITION STATES

No.	Date	Revision	By

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CHINAMANS BRIDGE
NAGAMBIE

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Date MAY 2024
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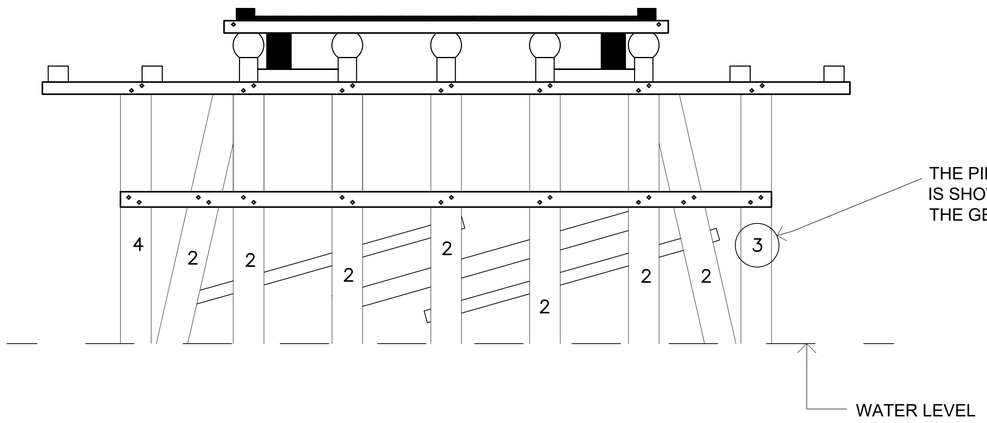
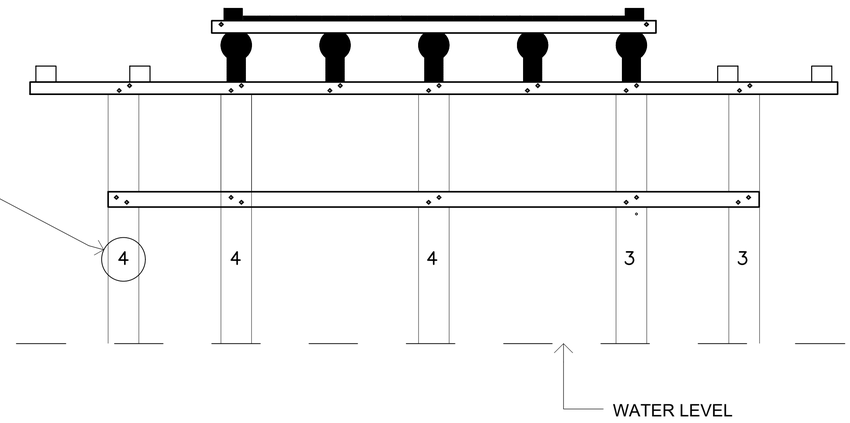
Drawing Title
SECTIONS

Project No	Dwg No.	Revision
3845	S10	A



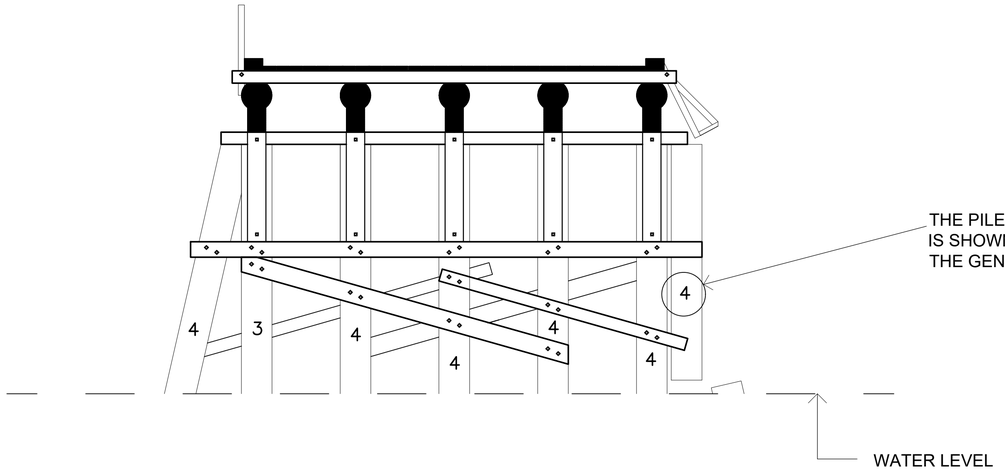
SECTION 10S / S1 TRESTLE No. 11 SOUTH VIEW

THE PILE CONDITION STATE IS SHOWN THUS. REFER TO THE GENERAL NOTES ON S1



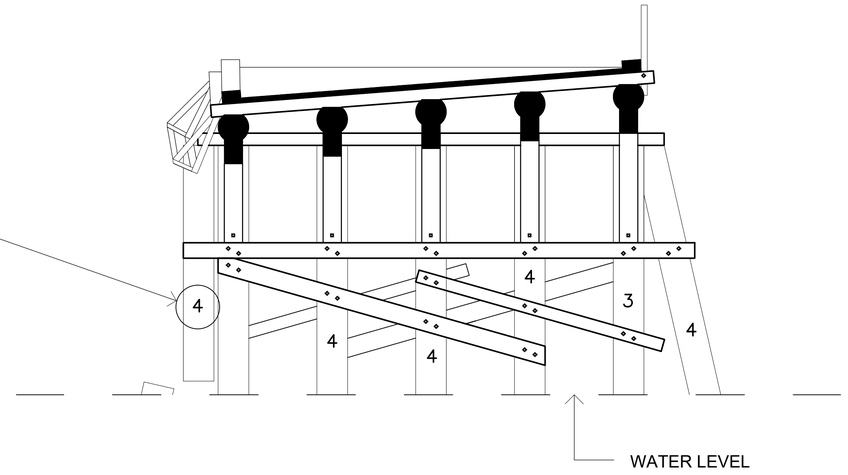
SECTION 11S / S1 TRESTLE No. 11 SOUTH VIEW
1:50

REFER TO THE GENERAL NOTES ON S1
FOR THE PILE CONDITION STATES



SECTION 12N / S1 TRESTLE No. 12 NORTH VIEW
1:50

THE PILE CONDITION STATE IS SHOWN THUS. REFER TO THE GENERAL NOTES ON S1



SECTION 12S / S1 TRESTLE No. 12 SOUTH VIEW
1:50

No.	Date	Revision	By

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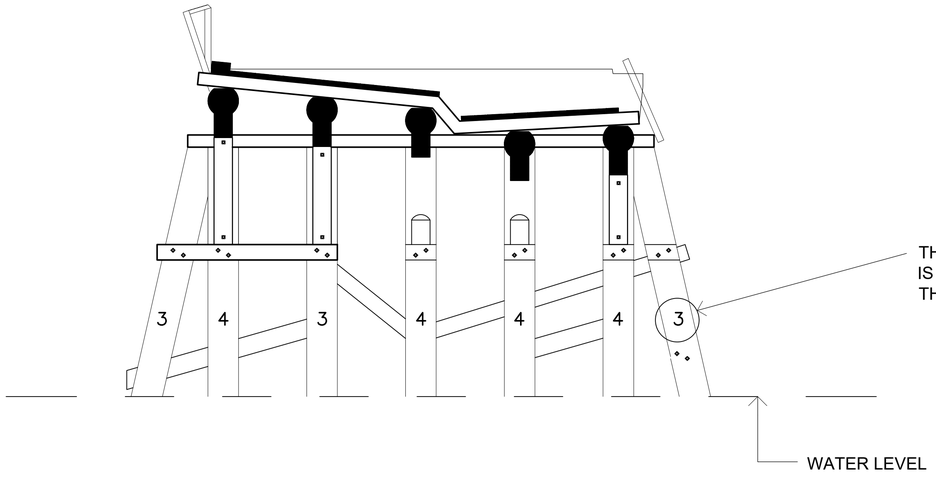
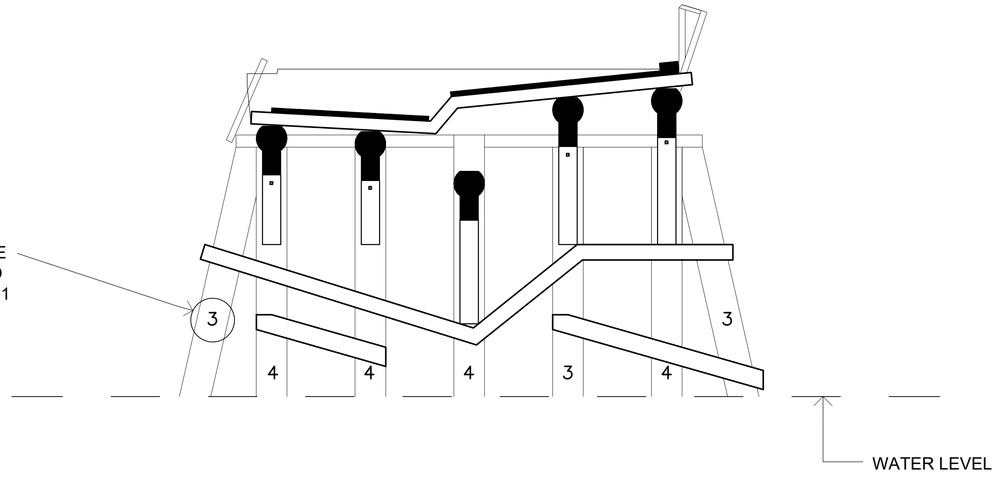
Drawing Title: SECTIONS

Project No	Dwg No.	Revision
3845	S11	A



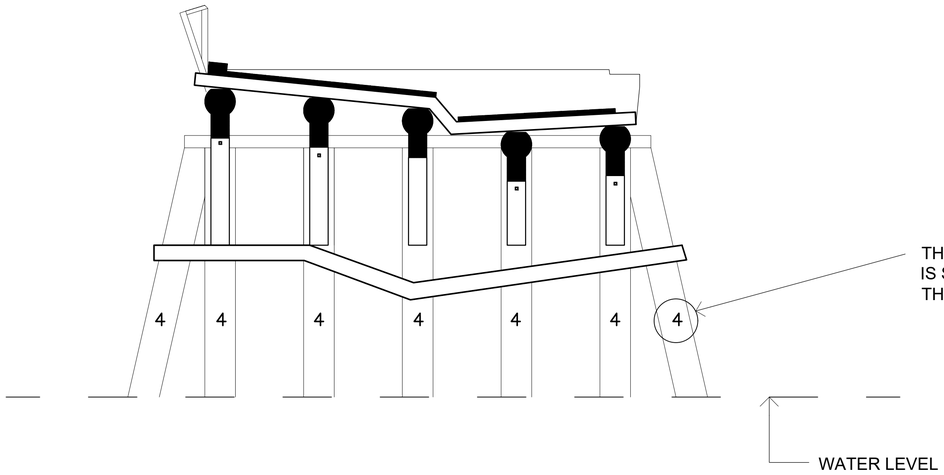
SECTION 13N / S1 TRESTLE No. 13 NORTH VIEW
1:50

THE PILE CONDITION STATE IS SHOWN THUS. REFER TO THE GENERAL NOTES ON S1



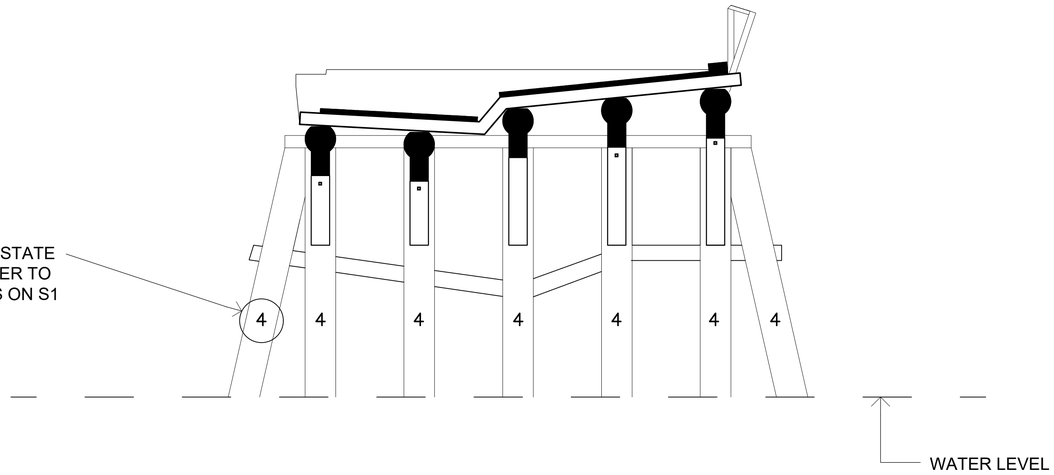
SECTION 13S / S1 TRESTLE No. 13 SOUTH VIEW
1:50

REFER TO THE GENERAL NOTES ON S1
FOR THE PILE CONDITION STATES



SECTION 14N / S1 TRESTLE No. 14 NORTH VIEW
1:50

THE PILE CONDITION STATE IS SHOWN THUS. REFER TO THE GENERAL NOTES ON S1



SECTION 14S / S1 TRESTLE No. 14 SOUTH VIEW
1:50

No.	Date	Revision	By

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Heritage Consultant
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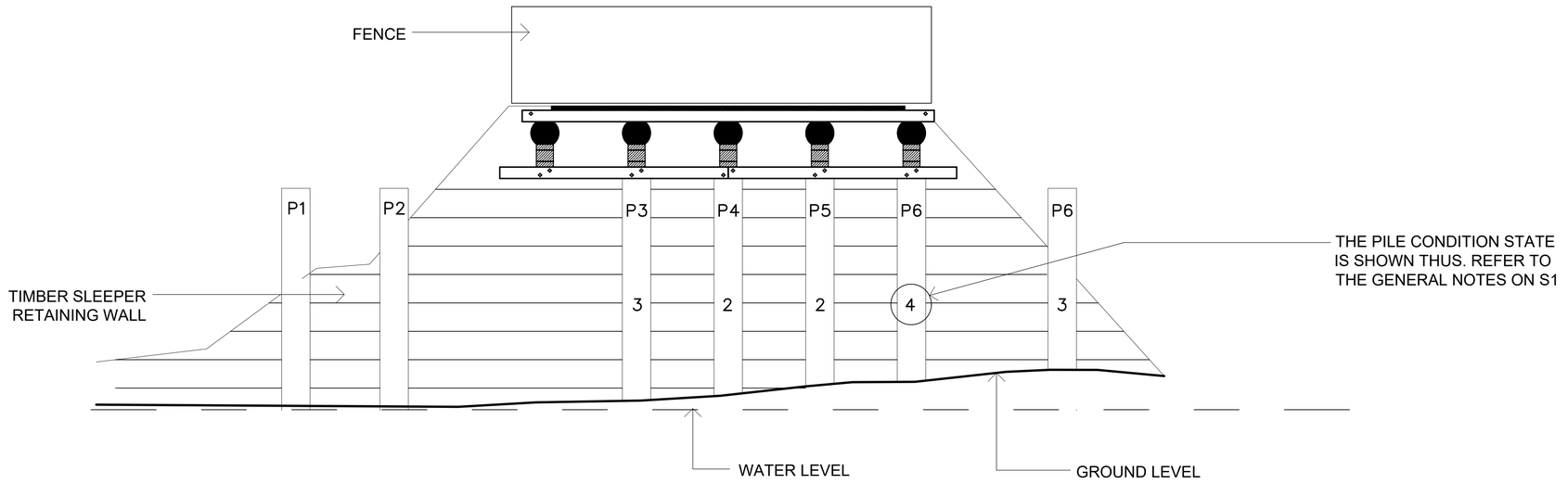
Client

Project
STRUCTURAL ENGINEERING CONDITIONS SURVEY
CHINAMANS BRIDGE
NAGAMBIE

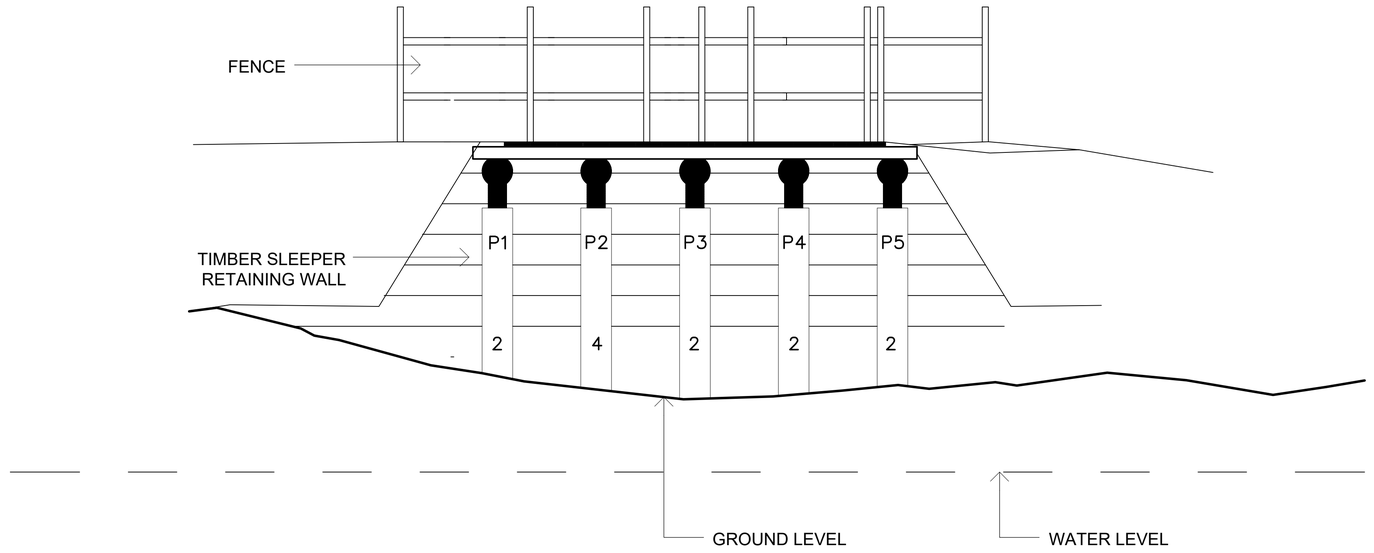
Drawn PWG
Design MH
Date MAY 2024
Scale AS SHOWN

Drawing Title
SECTIONS

Project No	Dwg No.	Revision
3845	S12	A



NORTH ABUTMENT ELEVATION
1:50



SOUTH ABUTMENT ELEVATION
1:50

No.	Date	Revision	By

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Heritage Consultant
EXTENT HERITAGE

Client

Project
STRUCTURAL ENGINEERING
CONDITIONS SURVEY
CHINAMANS BRIDGE
NAGAMBIE

Drawn PWG
Design MH
Date MAY 2024
Scale AS SHOWN

Drawing Title
AUBUTMENT ELEVATIONS

Project No	Dwg No.	Revision
3845	S13	A

APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 1

An aerial part view of the deck.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 2

A close up aerial part view of the decking.

APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 3

A view of the end of a plank showing the dry-rot.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 4

A view of the end of a plank showing the dry-rot.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 5

An aerial view of the cross-beams.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 6

A view of the ends of the cross-beams showing the extensive damage.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 7

A view of the end of a cross-beam showing the extensive damage.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 8

A view of the extensive damage in a stringer below the cross-beams.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 9

A view of the extensive damage in a stringer – see arrow.

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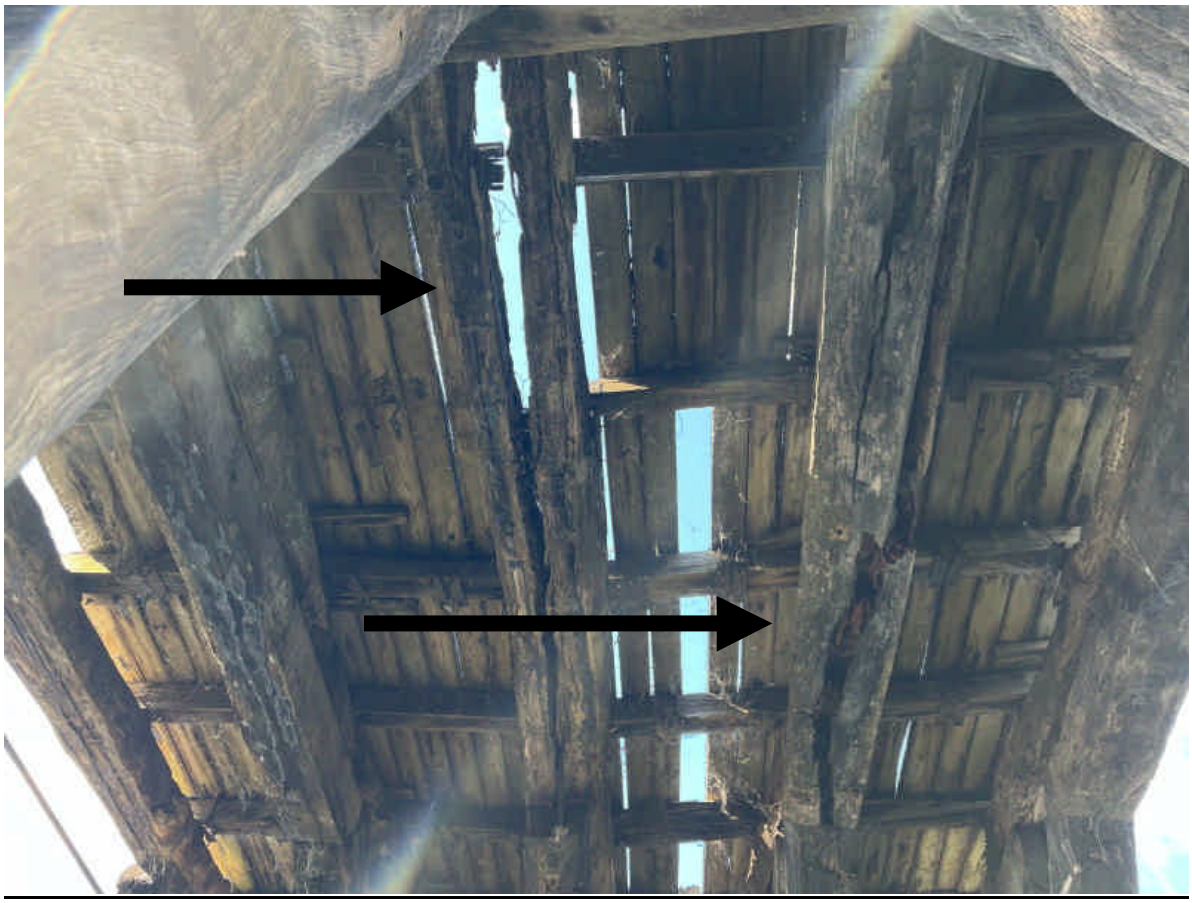
APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 10

A view of the extensive damage in two stringers – see arrow.



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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 11

A view of the extensive damage in two stringers.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 12

A view of the corbels – see arrows.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 13

A view of the corbels – see arrows.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 14

A view of the corbels – see arrows.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 15

A view of the new beams below the stringers.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 16

A view of the new beams below the stringers.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 17

A view of the new beams below the stringers.

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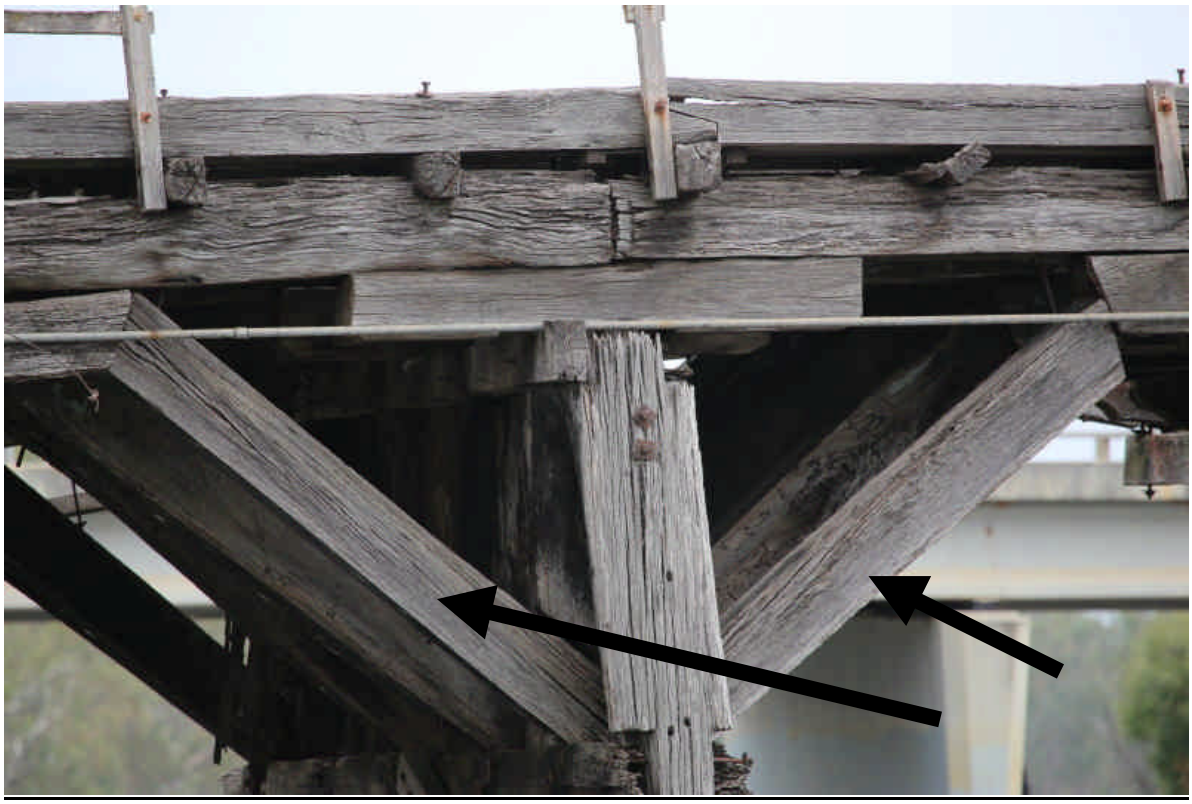
APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 18

A view of the knee braces – see arrows.



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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 19

A view of the knee braces.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 20

A view of the knee braces.

APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 21

A view of the cross head beams that support the steel beams.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 22

A view of the cross-head beam partial collapse.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 23

A view of the vertical and inclined piles.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 24

A view of the vertical and inclined piles.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 25

A view of Condition State 4 piles.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 26

A view of Condition State 4 piles.

APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 27

A view of Condition State 4 piles.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 28

A view of a Condition State 4 pile.

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APPENDIX C

TYPICAL INSPECTION PHOTOGRAPHS

Photograph 29

A view of Condition State 4 piles – see arrow.

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APPENDIX D

RTA PILE CONDITION STATES

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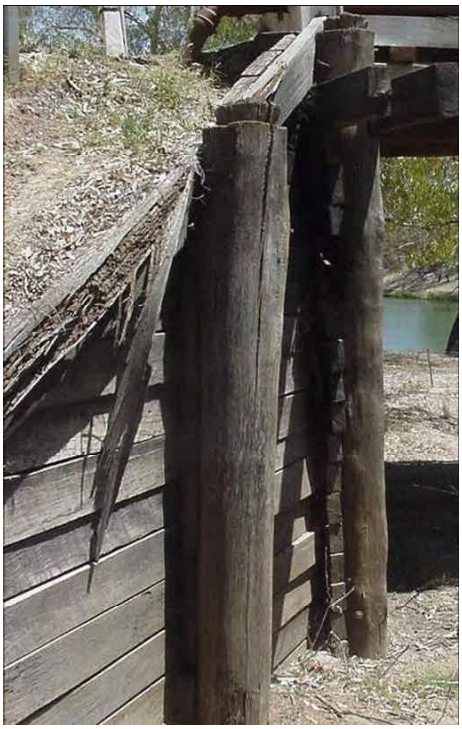
Timber- Piles TPIL

Condition State 1
The timber is in good condition with no evidence of decay. There may be cracks, splits and checks having no effect on strength or serviceability.

Timber piles in good condition.

Timber- Piles TPIL

Condition State 2
Minor decay, insect infestation, splitting, cracking, checking or crushing may exist but none is sufficiently advanced to affect serviceability.



Minor split in the pile.

Timber- Piles TPIL

Condition State 3
Medium decay, insect infestation, splitting, cracking or crushing has produced loss of strength of the element but not of a sufficient magnitude to affect the serviceability of the bridge.

Timber pile split and with indications of damage below ground.

Timber- Piles TPIL

Condition State 4
Advanced deterioration. Heavy decay, insect infestation, splits, cracks or crushing has produced loss of strength that affects the serviceability of the bridge.

Significant rot and major loss of section just below the ground surface.

Failed timber piles.

Timber- Piles TPIL

Condition State 4
Advanced deterioration. Heavy decay, insect infestation, splits, cracks or crushing has produced loss of strength that affects the serviceability of the bridge.

Major split on the pile.

Badly rotten pile.

APPENDIX E

MELBOURNE GEOTECHNICS REPORT

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Melbourne Geotechnics
CONSULTING GEOTECHNICAL ENGINEERS

File Number: 240252

Date: 03 April 2024

Client: EXTENT
C/- Mark Hodkinson Pty Ltd
624 Rathdowne Street
NORTH CARLTON VIC 3054

Distribution: - Mark Hodkinson Pty Ltd

RE: Site Investigation at Chinamans Bridge – Goulburn River, Nagambie

A site investigation was undertaken on 20 March 2024. The purpose of the investigation was to excavate test pits adjacent to existing bridge piers for visual inspection of the timber condition by the Structural Engineer.

Scope of the Investigation

The site investigation included the hand excavation of five test pits adjacent to existing timber piers.

Site Description

The bridge (circa 1870) spans the Goulburn River and is in various states of disrepair. The bridge is entirely made of timber and has a thin veneer of asphalt on the travel surface.

Melbourne Geotechnics
ABN 12 639 952 524

Subsurface Conditions

Regional geology

The site is identified on the 'Earth Resources' website (gsv.vic.gov.au) as being in the province of Quaternary; alluvium and associated soil profiles.

Subsurface profile

The excavated test pits intersected FILLING (mixed sand and silt) to a depth of approximately 600mm, underlain by natural loose SAND with some SILT to a maximum excavation depth of approximately 1100mm.

Soil moisture & groundwater

The FILL material and upper soils intersected were in moist condition.

The groundwater table was encountered at approximately 800mm-900mm below surface and consistent with the river level.

The groundwater level at the bridge piers will fluctuate with river levels.

Excavation below the water table experienced continual collapse.

Site Classification

The site is classified as **CLASS P** in accordance with AS2870-2011.

Please do not hesitate to contact us, should there be any further queries.

Yours faithfully,
Melbourne Geotechnics Pty Ltd